

Science Education in the National Interest



***Science &
Technology
Education
Program***

S ***Science &***
T ***Technology***
E ***Education***
P ***Program***

***Annual Report
FY00***

<http://education.llnl.gov/>

Lawrence Livermore National Laboratory

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Cover photos

Top Left: Dr. Ben Duran, president of Merced College, Dr. Bruce Tarter, director of Lawrence Livermore National Laboratory, and Dr. Carol Tomlinson-Keasey, chancellor of UC Merced, sign a Memoranda of Agreement to invest their resources to improve science and technology education. (Page 38)

Center Left: Students from Golden Valley High School, Merced Union High School District demonstrate their understanding of the principle of optics and light learned from a teacher who completed the Laser Science and Options in the Classroom program. The demonstration was conducted at the LLNL, UC Merced, and Merced College MOA signing. (Page 37)

Bottom Left: Ed Moses, project manager of the National Ignition Facility (NIF), presents a seminar about the development of the world's most powerful laser, to a packed auditorium of summer students. (Page 45)

*Top Right: Matthew Zimmerman of Cornell University
Major: Environmental Engineering; LLNL Program: Health and Ecological Assessment Division
Symposium 2000 Participant (Page 74)*

Center Right: Environmental scientist Dr. Andrea Cook and high school science teacher Stan Hitomi from Monte Vista High School, San Ramon Valley Unified School District, examine core samples used to date volcanic activity in Greenland. (Page 36)

Bottom Right: (Seated from right to left) "Decisions for Success" panel featuring Sandia Vice President Mim John, LLNL employees Ellen Raber and Judy Kammeraad, and KPIX investigative reporter Christi O'Conner. Panelists advise students and employees on how to shape success from dream and disappointment. (Page 46)

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December 2000

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Overview

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URL: <http://education.llnl.gov/>

Mission

The Lawrence Livermore National Laboratory (LLNL) Science & Technology Education Program (STEP) serves as the Lab's primary resource to students and teachers.

STEP leads the Laboratory's science education activities by:

- Educating future scientists through research internships for students entering careers important to the intellectual capability required by LLNL's national security mission, and
- Increasing the interest in and quality of science education through science outreach and K-14 educator partnerships with schools and school districts surrounding LLNL.

STEP's "school-to-career" education projects are important to the national security of the nation so that the United States can compete successfully in the world marketplace and remain a major economic power.

A common theme of the science education projects is the integration of education, research, and career options at all school levels – pre-college, undergraduate, and graduate school.



Having all three of the school levels within STEP's organization reflects the recommendations made by the Task Force on Education of the DOE Secretary of Energy Advisory Board (SEAB) on December 2, 1998.

The Task Force on Education Final Letter Report (<http://vm1.hqadmin.doe.gov/seab/educ.html>) stated "The Task Force believes the Department's mission justifies its dual role in educating future scientists, as well as in improving the public understanding of science:

- Ensuring a steady flow of scientists directly supports the Department's mission of maintaining a well-trained future laboratory workforce. Students with scientific aptitude should have opportunities at the Department's national laboratories and facilities where they can obtain the specialized research skills and hands-on experience working on projects that are unique to government research and development.
- It is also in the nation's best interest for the Department to use its resources to enhance public understanding of science. Citizens who have knowledge of science and technology are better-informed voters. The effect is to raise the quality of decision-making, understanding, and support for the Department's multifaceted programs and projects. Everyone learns math and science in grade school and, at this level, teachers have an impact on both potential scientists and average students."

The first of the two recommendations by the SEAB Task Force on Education falls with STEP's "Student Research Internships" projects. The second recommendation pertains to STEP's "Science Outreach and K-14 Educator Partnerships" projects. Both recommendations fall within STEP's mission: "Science in the National Interest."

Student Research Internships (Undergraduate and Graduate College)

STEP facilitates partnerships and collaborations with the education community to help ensure a highly skilled, diverse workforce for the science and technology challenges within the national security mission needs of the Department of Energy (DOE).

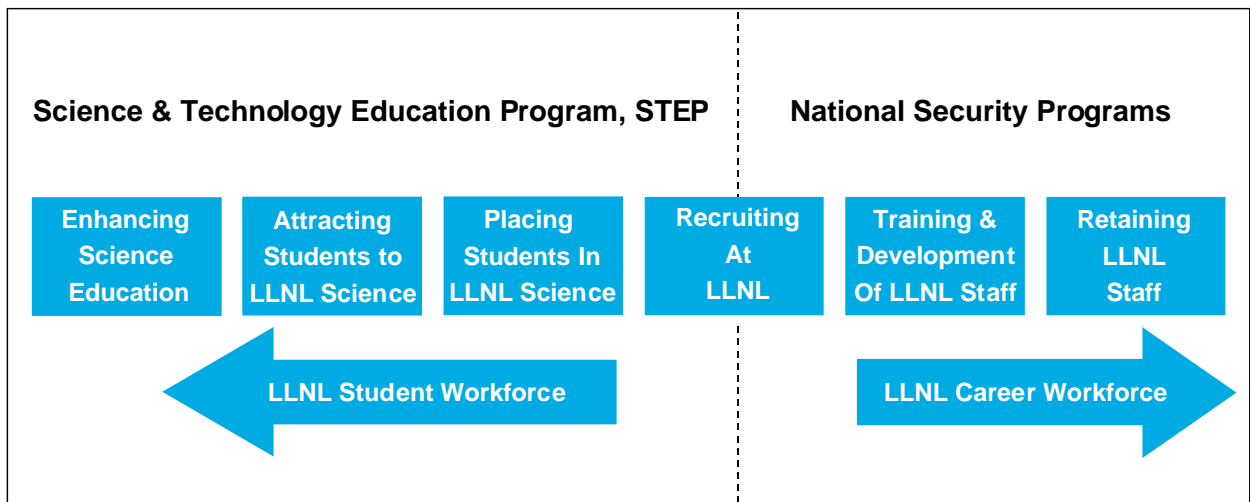
Internship projects within LLNL's Stockpile Stewardship Program are funded directly through the Department of Energy, Defense Programs (http://education.llnl.gov/step_student.html).

Individual internship projects support the recruiting needs of the LLNL Stockpile Stewardship Program, such as the Accelerated Strategic Computing Initiative (ASCI). These internship projects engage college students within the disciplines defined by the Chiles Commission report. The Chiles Commission was established by the Congress under the National Defense Authorization Acts of 1997 and 1998 and was chaired by retired Navy Admiral H.G. Chiles, Jr.

The Chiles report recommends specific strategies for recruiting and retaining the scientific, engineering, and technical personnel needed to maintain a safe and reliable nuclear weapons stockpile without engaging in underground nuclear testing. The LLNL Stockpile Stewardship Program's workforce needs can be captured by four major, critical skill disciplines:

- Computer Science/Math
- Physics
- Chemistry/Materials Science
- Engineering

STEP internship projects attract, place, and recruit students within these four disciplines.



During FY00, STEP placed 78 college student interns within the LLNL Stockpile Stewardship Program. An additional 34 were placed in various other national security research programs, for a total of 112 college student interns.

<i>Stockpile Stewardship Internship Projects (See Section 1)</i>	<i>Number of Interns</i>
Accelerated Strategic Computing Initiative (ASCI) Pipeline: <ul style="list-style-type: none"> • Northern Arizona University • California State University, Hayward • San Jose State University • University of the Pacific, Stockton, California 	7 4 2 1
Actinide Sciences Summer School	8
Graduate Interns for Nuclear Technologies	6
Internships in Terascale Simulation Technology	23
Military Academic Research Associates <ul style="list-style-type: none"> • Military Academies • ROTC 	19 4
System Administration Computer Support	4
National Security Student Internships (Associated Western Universities and Undergraduate Research Semester)	34

Science Outreach and K-14 Educator Partnerships

STEP motivates pre-college students to consider a college education as part of their future career choice. These pre-college science literacy activities play an important role in the creation of future scientists, engineers, and technicians by enlightening students to potential careers in science and technology, especially those of special interest to LLNL.

The Science Outreach (http://education.llnl.gov/step_outreach.html) and Educator Projects (http://education.llnl.gov/step_educator.html) are funded by the LLNL General and Administrative (G&A) Distributed Budget.

Through local and regional education partnerships, STEP leads the Laboratory's education efforts to stimulate greater interest in science and technology among teachers and school administrators, and to encourage more students to pursue scientific and technical careers after high school.

Through a cooperative effort with the education community, STEP has aligned its outreach projects with the new K-12 science standards established for the State of California (<http://www.cde.ca.gov/board/>).

During FY00, the science outreach and educator projects engaged 9,000 students and 1,200 teachers, often times in one-day workshops or events, in the following projects:

Science Outreach (students) (See Section 2)	<i>Participants</i>
Classroom/Career Days Speakers Bureau	1,400
Critical Issues Forum (students)	135
Crystals in the Classroom (students)	90
Expanding Your Horizons, EYH (3 conferences)	1,400
Explorer Post	50
Fun With Science (FWS)	4,000
Future Scientists and Engineers of America (FSEA)	50
Math Challenge	50
Science on Saturday (SOS)	1,600
Tri-Valley Science & Engineering Fair (TVSEF)	200

K –14 Educator Partnerships (teachers) (See Section 3)	<i>Participants</i>
Critical Issues Forum	5
Crystals in the Classroom (teacher development)	2
Educational Partnerships	710
Edward Teller Science Education Symposium	120
Internet Technology Computer Classes	245
Laser Science and Optics in the Classroom	30
UC Merced/Merced College School to Work	115

Directions for FY01

STEP will continue to serve as the Laboratory's primary resource to students and teachers. By providing a continuous school-to-career "roadmap" for pre-college, undergraduate or graduate students interested in science and technology, STEP's education projects will offer a seamless path for pursuing careers in science research.

Within STEP's **student research internships**, emphasis will continue to grow in support of the Lab's recruiting efforts inside the Stockpile Stewardship Program. STEP will focus its internships within the Critical Skills Discipline list, as defined by the LLNL Stockpile Stewardship Program (SSP) Workforce Plan sent to DOE-HQ in March of FY00. The list called out four primary disciplines, which are the same as those defined by the Chiles Report:

- Computer Science/Math
- Physics
- Chemistry/Materials Science
- Engineering

STEP has added a fifth primary emphasis after discussions with the Laboratory's SSP management:

- DOE/DoD Partnerships

The five callouts above (four scientific/engineering disciplines plus DOE/DoD partnerships) support many of the priorities for solving the long-term workforce needs of the Lab's national security mission.

Within STEP's **science outreach projects and K-14 educator partnerships**, emphasis will continue to grow in working with schools and school districts surrounding the Laboratory and within the State of California. For example, STEP – together with the University of California, Davis, and the University of California, Merced campuses – is exploring multiple responses to the California Subject Matter Projects, which is an UC-administered network of discipline-specific professional development projects for K-12 teachers.

The California Subject Matter Projects program provides year-round direct services to teachers through summer workshops, institutes, and additional support during the academic year. A partnership between LLNL, UC Davis, and UC Merced, along with each of their associates, would represent a unique aggregation of dedicated professionals, rich educational and scientific resources, and access to research scientists and world-class facilities.

The STEP Web site (<http://education.llnl.gov>) is continually updated to reflect these types of new directions in our student internship and K-14 activities. The STEP Web site banner remains the same as does our commitment to the mission of "Science Education in the National Interest."

Section 1 – Student Research Internships **(Undergraduate and Graduate College)**

STEP Contact: Barry Goldman, (925) 422-5177, goldman1@llnl.gov

Introduction

STEP offers numerous internships to undergraduate and graduate students in order to attract, place, and ultimately recruit the best technical workforce in support of the Laboratory's mission-based science.

During FY00, STEP internship projects placed a total of 78 college students within the research programs at LLNL in support of the DOE Stockpile Stewardship Program. The STEP internship projects at LLNL complement the educational and research opportunities provided by colleagues at the other two DOE Defense Programs national laboratories – Los Alamos National Laboratory (LANL) and Sandia National Laboratories (SNL).

Student interns who have been involved in the LLNL's mission-based science receive valuable research experiences, which, in turn, support their educational and career goals. Exposing interns to scientific research and scientific careers will increase the number of successful students who choose careers of importance to the LLNL national security mission.

In addition to the 78 students who conducted research within the LLNL Stockpile Stewardship Program, 34 interns did research within other programs that support the broad national security mission of the Laboratory.

Each of the six internship projects (as mentioned in the Overview table, page 3) are discussed individually in this section. A seventh program, the Accelerated Strategic Computing Initiative (ASCI) Jr. Capstone Research Course, was not included in the Overview table because the students were involved in courses at the Northern Arizona University, not as interns at Lawrence Livermore National Laboratory.

Accelerated Strategic Computing Initiative (ASCI) Pipeline

URL: http://education.llnl.gov/asci_interns/

Description

The goal of this project is to “increase the number of students majoring in computer science, particularly under-represented minority students who represent America’s ethnic diversity. Another is to increase student awareness of ASCI opportunities at DOE Defense Programs laboratories.”

This project increases student awareness of ASCI opportunities at DOE Defense Programs (DP) laboratories. Students work at the Laboratory for approximately 12 weeks on a variety of different projects in ASCI and Computation, which will ensure they have access and exposure to high-level computational science.

Summer students are recruited based on recommendations of math and computer science faculty and also through general recruiting efforts, specifically at targeted academic ASCI institutions. In the case of Northern Arizona University (NAU), recommendations may come from the Computer Science faculty, participants in the ASCI-PALS (ASCI-Pathways Leading to Success) program, the Multicultural Engineering Program, and through general recruitment efforts.

Students are required to design an electronic portfolio and give an oral presentation to peers within their work group.

Partners

Laboratory:

- Accelerated Strategic Computing Initiative
- Defense & Nuclear Technologies Directorate
- Computation Directorate

Non-Laboratory:

- California State University, Hayward
- Northern Arizona University (NAU)
- University of Utah/CSAFE
- San Jose State University
- University of the Pacific

Objectives and Metrics

- Fills a well-defined need within Defense Programs line organizations; specifically, through the encouragement and support of more graduates with bachelor of science degrees in computer science, who are then employable within the Laboratory's ASCI-related programs.
- Fulfills a need for more U.S. citizen-computer science graduates with a background in the scientific parallel processing environment to work at LLNL or other DP-managed Laboratories.
Metric: Evaluate the number and percentage of students who are offered and accept positions at DP laboratories.
- Increase capability, capacity, and quality of computer science B.S.-degree candidates at local universities.
Metric: Engage self-sufficient faculty having tenure and recognition (without the need of Laboratory staff) to teach specialty courses, such as parallel processing.
- Provide graduate opportunities at the first-level ASCI Alliance schools.
Metric: Establish memorandum of understanding between alliance level institutions and targeted four-year colleges to promote graduate opportunities and Laboratory hires – M.S. and Ph.D. Involve the four-year computer science departments to help ensure that its B.S. graduates are capable of entering the ASCI Alliance graduate schools.

FY00 Accomplishments

- Nine of the 12 ASCI Pipeline 2000 summer students are being placed in an indeterminate status in anticipation of future Laboratory job opportunities. Two of these students will continue working with LLNL Departments during the school year. All seven of the Northern Arizona University (NAU) students are being retained in an indeterminate status.
- One ASCI CSUH Pipeline 2000 Summer student is being placed in an indeterminate status and will continue working with LLNL Departments during the school year in anticipation of future Lab job opportunities. This individual has assisted with the performance analysis of the parallel file system for the new ASCI platform, White.
- Rebuilt credibility among Laboratory researchers for NAU students.
- Recruited two students from San Jose State University, one from an underrepresented group (disabled).
- Maintained involvement of ASCI PALS and Multicultural Engineering Program participants involved in the project.

Continued on next page

FY00 Accomplishments *continued*

- Established high-performance computing seminar series (optional participation) for students to include the ASCI Pipeline participants.
- Livermore Computing Department hired an underrepresented computer science graduate from Northern Arizona University who participated in the ASCI-PALS program. He was a summer student at LLNL during the 1999 Summer Program.
- Two of the nine FY99 ASCI-PALS participants accepted internships with IBM in FY00 and one became employed by Federal Express in Colorado.
- ASCI Pipeline interns participated in the LLNL Lab-wide symposium presentation (see Section 4).

New this summer, a high-performance super-computing lecture series was offered as optional seminars for computer science students in addition to the typical summer student seminars and socials. See Appendix 3.

Evaluation/Assessment

- Feedback from FY99 participants resulted in a better selection of the FY00 applicants, matching of their assignments and issues pertaining to overtime, work hours and performance.
- Evaluations continue to be ongoing and include a variety of instruments, including reflective feedback, focus meetings with the supervisors and students, personal meetings, questionnaires, seminar discussion groups, results of the various classes, and student products.

Actinide Sciences Summer School Project (ASSSP)

URL: <http://education.llnl.gov/asp/>

Description

The purpose of the Actinide Sciences Summer School Project (ASSSP) is to address the long-term manpower and core-competency needs of the defense-related programs within DOE through supporting of actinide chemistry, physics, and materials science. To accomplish this, we are partnering with the Glenn T. Seaborg Institute for Transactinium Sciences (GTS-ITS) at LLNL, whose purpose is to provide education and research training in transactinium science for undergraduate and graduate students. Through this partnership, the ASSSP is aimed at undergraduate students who have shown an interest in the field of nuclear science, e.g., at the Nuclear Summer Schools at San Jose State University and Brookhaven National Laboratory. These summer school projects are funded by the DOE/Basic Energy Science (BES) and are sponsored by the American Chemical Society (ACS).

The LLNL ASSSP project is a laboratory-based project, which builds on the classroom education obtained from the San Jose State and Brookhaven Nuclear Summer Schools. The ASSSP is a University of California, Berkeley accredited class that offers hands-on laboratory work with actinides and training in the use of state-of-the-art instrumentation. In this regard, the ASSSP at LLNL is unique (being laboratory-based) and complements the ACS summer schools as well as the recently established classroom-based school at the University of New Mexico (sponsored by Los Alamos National Laboratory).

ASSSP students are partnered with LLNL scientists on research projects where they are offered valuable laboratory experience with plutonium and other actinides. They also receive training in the use of state-of-the-art nuclear instrumentation.

Scientific staff members from research programs at LLNL act as individual mentors to the students and serve as counselors for educational possibilities that may exist. During the eight-week-long project, distinguished actinide scientists from across the United States are invited to give presentations to the students. At the end of the ASSSP, the students are required to present their results in the form of a poster presentation to Laboratory staff. A committee, consisting of University of California, Berkeley professors and LLNL staff, works together to determine grades based on student research projects and presentations.

It is essential to encourage student interest in this field through to college graduation and aid students in their pursuit of graduate studies or careers in actinide sciences. The importance of the ASSSP is intensified by the shortage of actinide experts at DOE facilities and, in fact, the world. This sector of the scientific community continues to retire, leaving ever-widening gaps in the core capabilities of the programs and disciplines throughout the DOE complex.

Partners

Laboratory:

- The Glenn T. Seaborg Institute for Transactinium Sciences (GTS-ITS)
- LLNL Chemistry & Materials Science, Engineering, and Energy Directorates

Non-Laboratory:

- The American Chemical Society
- Brookhaven and San Jose State University (ACS Radiochemistry Summer Schools)
- Los Alamos National Lab and the University of New Mexico
- U.S. student participants
- U.S. universities, i.e., University of California - Berkeley, University of Tennessee, Massachusetts Institute of Technology, Washington State University

Objectives and Metrics

- Give students exposure to the actinide sciences so that they may consider careers in these fields that are at the heart of the DOE mission: stockpile stewardship, nuclear energy, environmental remediation, and radiochemical diagnostics.
- Assist the Laboratory and DOE by educating and training the future generation of scientists in the knowledge and expertise required to meet the nation's changing needs in environmental protection and remediation, nuclear waste isolation, national security, nuclear surveillance, nuclear energy and industrial applications of nuclear methods.

Metric: Evaluate the number of students who pursue advanced degrees in actinide science and/or who pursue careers at DOE within the field. Survey the student participants and their mentors at the end of the project to assess the ASSSP.

FY00 Accomplishments

- Hired a previous ASSSP student as an LLNL Seaborg Institute post-doctoral student.
- Established University of California, Berkeley course credits for ASSSP participants.
- Recruited eight students for FY00 from diverse backgrounds, which included 75% female participation as well as representation from the African-American community.
- Initiated a formal, more efficient process for matching students with mentors and appropriate research projects.
- Seventy-five percent of the ASSSP students were previous ACS summer school students.

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FY00 Accomplishments *continued*

- Lecture series enabled the ASSSP students to meet pioneers/leaders in the field of actinide science. Bringing these scientist under the ASSSP forum afforded our students an opportunity they would otherwise not have.
- Curriculum established with the assistance of the ASSSP steering committee.
- Students were hired on as regular LLNL summer employees.
- Established dedicated office space which facilitated interactions between students and LLNL scientists.
- Provided students with appropriate state of the art computational facilities based at LLNL.
- Each student participated in a formal poster presentation on their research and results.
- Students completes a questionnaire at the end of the ASSSP that is used to evaluate the project.
- Identified and provided students with the appropriate safety courses.
- A poster session was included in the educational experience, allowing the participants to display and share their work with peers and experts at LLNL while also learning the technique of designing a poster. A listing of the students, their poster presentation titles, and school affiliations can be found in Section 4.
- The institute emphasizes training at the undergraduate through postgraduate levels. In this way the University of California's Glenn T. Seaborg Institute for Transactinium Sciences is making a long-term investment in the future. Workshops and lectures are included as a component of the research experience and focus on national security, nuclear energy, environmental protection and remediation, and nuclear waste isolation and disposition. Workshops and lectures can be reviewed in Appendix 3.

Evaluation/Assessment

Feedback from earlier summer projects hosted by the GTS-ITS has indicated that many bright individuals are stimulated by this scientific experience early in their educational careers and have been encouraged to continue in a technical career. For this project, we will review the evaluation template used by the Education Program for their student internships and modify it for this project so that we may conduct a formative assessment of the participants in addition to exit interviews to obtain direct feedback and indication of goal attainment. The entire project will be reviewed by external experts as part of our directorate's review process with summative evaluation to follow. We also survey the student participants and their mentors at the end of the project to assess the ASSSP.

Graduate Interns for Nuclear Technologies (GINT)

URL: <http://education.llnl.gov/gint/>

Description

The purpose of the Graduate Interns for Nuclear Technologies (GINT) is to prepare undergraduate and graduate students, who are U.S. citizens, in nuclear, mechanical, electrical, and materials engineering with research opportunities leading to the completion of master's degree and doctoral thesis research. Upon completion of their 12-week internships and thesis research, the best of these students will be recruited for employment in Defense Technologies Engineering to work on DOE Defense Programs projects.

Defense Technologies Engineering has two roles at LLNL: 1) It is a programmatic organization in Defense & Nuclear Technologies (D&NT), responsible for LLNL's designed nuclear weapons to ensure their integrity and reliability throughout their stockpile life; 2) It is also a Mechanical Engineering Division, primarily supporting the Stockpile Stewardship Programs.

Defense Technologies Engineering and STEP will collaborate with University of California (UC) campuses to identify qualified undergraduate, master's degree and doctoral students to participate in GINT. Faculty from these campuses will nominate students to participate in GINT. The students selected will be assigned a research mentor with experience consistent with the research interests of the student. The student, faculty advisor, and research mentor will define the scope of the project so that it involves only unclassified work.

The faculty advisor may arrange for the student to receive academic units for advanced laboratory or thesis research throughout the internship. The research mentors will oversee their students' research work at LLNL and will provide the faculty advisor with a written report summarizing the students' progress.

Partners

Laboratory:

- Defense Technologies Engineering
- Engineering Directorate

Non-Laboratory:

- University of California and other state and national campuses
- Stanford University

Objectives and Metrics

- The GINT project leads to the employment of U.S. citizens educated in nuclear, mechanical, electrical, and materials engineering at LLNL and other DOE DP laboratories. A significant number of the applicants for engineering positions are foreign-born citizens, not U.S. citizens, with many from sensitive countries. Consequently, these applicants may not be eligible to work on the Stockpile Stewardship Program and other DP-related projects.
- Make offers of employment to the students participating in the internship project to work at LLNL or DP-managed laboratories.
Metric: Track the number of offers for employment and/or students being recruited for future employment efforts.

FY00 Accomplishments

- Identified and hired six students into the project.
- All six students retained in indeterminate status for future employment possibilities.
- Interns developed and produced Web sites, fliers, and posters.
- Defense Technologies Engineering increased its support of this educational project, in that it more than doubled its leveraged funds for FY01.
- Initiated a collaboration with Stanford University to develop program called the Six Degrees of Freedom Sensor which has very relevant technology to the LLNL Weapons Program.
- One GINT student participated in the LLNL lab-wide symposium presentation (see Section 4).
- GINT interns participated in the numerous summer lectures and tours offered by the Laboratory (see Appendix 3).

Evaluation/Assessment

Evaluations in general are ongoing and include a variety of instruments, including reflective feedback, focus meetings with the supervisors and students, personal meetings, questionnaires, seminar discussion groups, results of the various classes, and student products. Because this is the first pilot year and the end of the summer, input from the FY00 assessment is not yet available.

Internships in Terascale Simulation Technology (ITST)

URLs: <http://education.llnl.gov/CASC/> and <http://education.llnl.gov/itst/>

Description

The purpose of the Internships in Terascale Simulation Technology is to prepare advanced undergraduate and graduate students for employment as computational scientists. This is done by providing hands-on experience using Massively-Parallel Processing (MPP) systems, mentoring from expert computational scientists, and giving them specialized instruction in computational mathematics and scientific visualization techniques provided by a dedicated Livermore Computing training staff, special guests, prominent Institute for Terascale Simulation (ITS) scientists, and scholars. This instruction includes interdisciplinary (mathematics-engineering) approaches necessary to work with terascale parallel processing machines. Participation in this instruction is open to all LLNL and Sandia National Laboratory (SNL) scientists.

The Accelerated Strategic Computing Initiative (ASCI) Institute for Terascale Simulation (ASCI-ITS) research mission requires computational scientists to have knowledge of the physical applications used in ASCI, computer architecture and numerical mathematics. This proposal offers six research topics, two from each of these three corresponding ASCI-ITS and Center for Applied Scientific Computing (CASC) research responsibilities.

Computer science/visualization

1. *Exploration of terascale data sets:* The ASCI data exploration and management efforts develop techniques and tools enabling the effective use of the data generated by applications running on the ASCI platforms.
2. *Parallel programming paradigms:* This project improves the development process and performance of large-scale scientific applications by investigating and developing parallel programming models.

Computational Mathematics

3. *Adaptive mesh refinement for Partial Differential Equations:* Adaptive Mesh Refinement is an important simulation methodology that provides both spatial and temporal refinement to focus computational resources in targeted portions of the computational domain.
4. *Scalable methods for coupled nonlinear systems:* Scalable parallel solution strategies for nonlinear differential equations discretized on three-dimensional meshes having upwards of one billion spatial zones.

Description *continued*

ASCI Applications

5. *Simulation of transport*: Scalable algorithms for the time-dependent and steady-state differential equations that model the flow of neutral particles through materials.
6. *Computational laser and plasma*: The ability to simulate laser plasma interactions by solving the underlying governing equations on parallel computers, using parallel adaptive mesh refinement.

All six of the proposed topics can be supported in FY01 or the number can be scaled to best match the immediate DP-mission needs. In general up to four students would participate in each of the topic areas. The participants skills ultimately will determine the support to any given project.

Partners

Laboratory:

- Center for Applied Scientific Computing, the Institute for Terascale Simulation, and the Institute for Scientific Computing Research (see <http://www.llnl.gov/casc/isr/>)

Non-Laboratory:

- Professional societies to help recruit applicants may include the Society for Industrial and Applied Mathematics and the American Physical Society

Objectives and Metrics

- The purpose of the STEP-ITST is to create a pipeline of trained and motivated potential employees for the Stockpile Stewardship Program by bringing them into the ASCI-ITS as graduate and advanced undergraduate students. The charter of the ASCI-ITS at LLNL is to collaborate with academia on research topics in computer science, computational mathematics, and scientific computing relevant to the Stockpile Stewardship Program.
- Recruit qualified ITST students to seek employment at LLNL as computational scientists.
Metric: Evaluate the number and percentage of students who are offered and accept positions at LLNL.
- Reduce the training time of new Ph.D. graduates hired at LLNL as computational scientists.
Metric: Evaluate the internship training and compare “ramp-up” time of new Ph.D.s to those who participated in internship projects.

FY00 Accomplishments

- Placed 21 of the 24 students (87.5%) in an “indeterminate” status in anticipation of future job opportunities at Lawrence Livermore National Laboratory. At least one, maybe more of the ITST students, is expected to stay at the Laboratory during fall 2000.
- Number of students assigned per project was predominately on computer science topics.
- Identified instructors and developed seminars for internship classroom instruction – referred to as the ITST Lecture Series at http://education.llnl.gov/itst/itst_schedule.html

Evaluation/Assessment

- Evaluations in general are ongoing and include a variety of instruments, including reflective feedback, focus meetings with the supervisors and students, personal meetings, questionnaires, seminar discussion groups, results of the various classes, and student products. This being the first pilot year and the end of the summer, input from the FY00 assessment is not yet available.
- An ITST Lecture Series was offered to not only the ITST students and Center for Applied Scientific Computing (CASC) but open to all summer students. This was a series of 20 lectures, given twice weekly, over the span of two months. See Appendix 3. Assessment input from this pilot indicates the topics were well received but the length could be shortened to a six-week series. Consideration is also being given to making the attendance at the series mandatory for the ITST participants.
- Included in the educational experience is a poster session, allowing the participants to display and share their work with peers and experts at LLNL while also learning poster design techniques. A listing of the students, their poster presentation titles, and school affiliations may be found in Section 4.

Military Academic Research Associates (MARA)

URL: <http://education.llnl.gov/mara/>

Description

The two goals of the Military Academic Research Associates (MARA) project are: 1) to foster a stronger relationship with the military and enhance the tie between the Department of Defense, Lawrence Livermore National Laboratory, the Department of Energy, and the Office of Defense Programs and 2) address the Chiles Commission and the need for a future workforce following military commitment or retirement. LLNL has been working with the undergraduate military academies as well as several of the graduate institutions to provide internship opportunities for military cadets/midshipmen. The military cadets and midshipmen are given the opportunity to participate in ongoing collaborative, multidisciplinary teams pursuing scientific and technical solutions to some of our nation's most challenging problems, many of which address areas critical to national defense.

Cadets/midshipmen are recruited through partnerships with the Air Force Academy, the Naval Academy, the Naval Post-Graduate School, the Air Force Institute in Technology, West Point, and others. Thus far, we have successfully partnered with all of the aforementioned academic institutions to provide summer experience tours and semester internships. We will aggressively recruit projects for cadets/midshipmen in the winter and these will be communicated to students in January through March. Cadets/midshipmen bid on assignments in February with final decision on their summer tours being resolved in March and April. Discussions are also taking place to encourage academy faculty to experience research at LLNL.

The Reserve Officer Training Corps (ROTC) allows university cadets and midshipmen to participate in the same MARA hands-on experience (hired as summer students) for full 12-week internships.

Partners

Laboratory:

- Defense and National Security Directorates within LLNL and Sandia National Laboratories

Non-Laboratory:

- U.S. Naval Academy (USNA)
- U.S. Coast Guard (USCG)
- U.S. Air Force Academy (USAFA)
- Air Force Institute of Technology (AFIT)
- Naval Postgraduate School (NPS)
- West Point (USMA)

Objectives and Metrics

- As stated by the Deputy Associate Director, Military Affairs, National Security Directorate, “Today’s cadets and midshipmen are the next generation of leaders for their respective services. What they learn at a DP lab will help shape their future ability to understand the broader defense capabilities of the country – including those that reside at Lawrence Livermore National Laboratory.”
- Establish a pipeline for recruitment following the MARA’s military commitment or retirement.
- Expose cadets/midshipmen and graduates to military research at LLNL.
Metric: Placement of cadets/midshipmen and graduates in hands-on research experiences.
- Facilitate civilian/military faculty and research collaborations.
Metric: Initiate discussions between LLNL and the academies in support of collaborations like HyperSoar and the National Ignition Facility (NIF).
- Ensure that cadets/midshipmen benefit from the technology experience (and techniques gained), the networking, publications, and exposure to issues of national defense.
Metric: Evaluate the quality of student responses to assessments (as judged by STEP personnel), the quality of students’ work (as judged by their mentors); the ability of students to work with less supervision; the quality of the student responses as judged by their mentors and STEP personnel.

FY00 Accomplishments

- A MARA Web site (<http://education.llnl.gov/mara/>) posts recent portfolios of participants.
- The LLNL Director Bruce Tarter requested a MARA poster series being designed for display in FY01.
- One MARA cadet from Embry-Riddle was employed for the summer at Oak Ridge National Lab.
- The National Security Directorate leveraged \$100K in funding to retain the MARA project at LLNL.
- Maintained MARA placements at 19 cadets and midshipmen and one faculty (nine USNA, four USMA, four USAFA, one USCGA, one VMI, and one faculty from USMA).
- Facilitated expediting invoices from the participating academies to bill LLNL departments who are sharing costs in support of the cadets and midshipmen.

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FY00 Accomplishments continued

- Expanded summer placement of ROTC cadets to four students.
- Reduced MARA costs by facilitating housing with Oakwood Housing (approximately \$15K) instead of Residence Inn (approximately \$35K).
- Facilitated visit by Air Force General Lloyd “Fig” Newton as keynote speaker to ROTC Day. (Unfortunately, because of last-minute scheduling conflicts, General Newton and Air Force Brigadier General Thomas Gioconda were unable to attend.)
- Hosted 4th ROTC Day on May 10, 2000. Approximately 43 cadets and midshipmen from within California participated and facilitated a successful panel discussion comparing the future careers in the military with the need for knowledge in technology, science and engineering.
- Initiated Critical Issues Forum briefings to Novoto and Fairfield High School and JrROTC instructors recertification workshop in Sacramento (30+ participants) in effort to expand pipeline and communicate MARA project to college-bound high school students.
- The electronic portfolios in FY01 were more comprehensive and included photographs of almost all of the participants, not only in uniform but also working in their research area.
- MARA briefings/tours are accessible through this Web site:
http://education.llnl.gov/mara/MARA_schedule.html
- Because the cadets and midshipmen are on assignment only four to six weeks, the focus is participation in a research experience. The cadets and midshipmen, on a case-by-case basis, could be included in future publications as technical/scientific support. However, it is unlikely they would author or co-author any publications.
- MARA briefings were mandatory and the participants were required to attend in uniform. The briefings were designed to increase the cadets and midshipmen awareness of the military research being performed at LLNL and to stimulate networking as they grow into their future responsibilities. Briefings ranged from overviews of the Lab and national security programs to specific briefings and tours of the National Ignition Facility, DoD technologies, a weapons program overview, etc. These briefings can be reviewed in Appendix 3.

Evaluation/Assessment

- Evaluations are ongoing and include a variety of methods: reflective feedback, personal meetings, questionnaires, seminar discussion groups, results of the various classes, and the result of cadet/midshipmen research projects.
- FY00 input supports changes implemented from FY99. Fewer requirements (classes and deliverables) were required of the participants. MARA briefings were tied more closely to DoD projects at LLNL. Attendance at briefings continued to be mandatory, which with a roster, resulted in improved participation.
- Lodging involved four students sharing an apartment (rather than two), which was satisfactory to the students. However, the apartments were close to the freeway (traffic noise) and the apartment complex housed some noisy tenants who caused several disturbances. In addition, not all MARA participants were not kept in the same complex, which led to some feelings of isolation. Some of these issues have been addressed; while others, due to the substantial costs savings, may not result in quick solution.

System Administration Computer Support (SACS)

URL: <http://education.llnl.gov/SACS/>

Description

The goal of this project is to develop and implement a comprehensive program that integrates classroom learning with workforce preparation and training in support of computer science systems administration for national security at the DOE laboratories. LLNL technical staff will engage two-year and four-year academic institutions to collaborate in establishing with faculty and students a curriculum and certification program to train students so that they may be qualified for entry-level skilled technical positions. This pilot is being modeled after the Advanced Manufacturing for Education program, sponsored by Sandia National Laboratories, New Mexico.

Systems Administration Computer Support (SACS) is an initiative to institute partnerships between industry and two-year and four-year academic institutions to create opportunities for students to become prepared for the world of work in the emerging high-performance computing industry. This project's mission is to bring career awareness and high-tech job skills to community college and university students. Another goal is to encourage industry to recognize its role in the training of the technical workforce, which is essential to industry success in the 21st century.

Partners

Laboratory:

- Computation Directorate in support of the Accelerated Strategic Computing Initiative, the National Ignition Facility (NIF) program, Chemistry and Material Sciences, Business Operations, and Systems and Network Department.

Non-Laboratory:

- Las Positas College, Livermore, CA

Objectives and Metrics

- This project complements and enhances the Defense Programs mission because it:
1) focuses on core competencies required to complete the Laboratory's work, including the recent focus on technical computer security; 2) draws on unique Laboratory capabilities and computing environments; 3) leverages resources and is cost effective; 4) increases opportunity to develop greater public understanding of the DP national laboratory missions; and 5) engages partners and collaborators that value laboratory input to the curriculum and/or courses.
- Provide job placement assistance for students completing the certificate program, including job search and application process, and locate employment opportunities.
Metric: Assess the number of students who become LLNL full-time employees and the number of students who enter the workforce within two months of completing the project.
- Establish a community college systems administration certificate program emphasizing advanced, hands-on technical training and relevant experience for students enrolled in college courses.
Metric: Evaluate the acceptance of this project by a community college and the LLNL programs.
- Provide co-op work experience programs for students to develop skills using school course material with job duties.
Metric: Determine the number of students and teachers involved; track students entering into LLNL internships, evaluate the quality of the students as judged by LLNL personnel and community college faculty.
- Provide faculty training and internships to encourage transfer of technology skills into the classroom and increase understanding of workforce needs and concerns.
Metric: Assess the number of teachers involved; track faculty in LLNL internships; track the curriculum changes in the colleges; and review students' materials.

FY00 Accomplishments

- Placed four students in summer internships. All four are being requested by their respective programs to continue into the fall on a part-time basis.
- Implemented collaboration with Las Positas College, including: Corey Kidwell, Dean of Academic Services, Vocation and Economic Development; Leslie Gravino, LaPTechs Program Coordinator; and Keith Jolly, Computer Information Systems/Computer Systems Coordinator.

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FY00 Accomplishments *continued*

- Systems and Network Department representatives participated in curriculum focus meetings (community college consortium) in the Bay Area. Resulted in major impact in the curriculum development for the 2001 program of two focus areas: Technical Support and Network Certification.
- Initiated conversation with Las Positas College staff to design a Systems and Network certification program.
- Initiated discussion and preliminary identification of faculty for sabbatical and/or summer internship to design certification program.
- Participated in Las Positas College Career Fair.
- LLNL Systems and Network Department representatives attended and were guest speakers for a Las Positas College class. Pilot interns are required to participate in all training (required or optional) available to all system and network administrators.

Evaluation/Assessment

Evaluation instruments still need to be developed in collaboration with the participating schools. We will seek advice and participation from our educational partners, particularly at the four-year academic institutions, in the development and assessment of this curriculum.

Regarding the curriculum/course certification, the intent will be to design questionnaires for students to assess their computer science skills, educational and career objectives before and after the course. Regarding internships, the intent will be to design questionnaires for students and their mentors so that we may assess the participants' computer science skills and impact from the experience.

Accelerated Strategic Computing Initiative (ASCI) Jr. Capstone Research Course

URL: http://education.llnl.gov/class_course/

Description

In an effort to promote American students' interest in pursuing scientific and technical careers, the Department of Energy has championed partnerships between its world-class national laboratories and U.S. universities. One example of this is the Accelerated Strategic Computing Initiative Jr. Capstone pilot. The goal of this program aims to increase the numbers of Native American and other minorities working in the new scientific discipline of high-performance, computer-based modeling and simulation. In January 1999, Gil Weigand recognized Northern Arizona University (NAU) for its successful participation in this partnership. The program involves DOE, Lawrence Livermore National Laboratory, the University of Utah, and IBM. Northern Arizona University serves many students of Native American heritage. Students in the NAU Engineering Program will have the opportunity to work on the next generation of supercomputers and experiment with distance learning.

The LLNL Junior Capstone Program component allows university students the opportunity to take the theory they have been learning and apply it to ongoing real-life problems, which are ASCI-related and involve simulation and modeling. Topics are selected by NAU faculty in collaboration with LLNL technical staff to match the student research interests and strengths to provide the best research training for the undergraduate participants. In FY99, this pilot ran in four sections or departments (civil and environmental engineering, electrical engineering, mechanical engineering, and computer science).

Regarding the 386 Jr. Capstone component, the identified problems are solvable by a small team of students and the students are tele-mentored by researchers and their faculty. Basically, this will allow students the opportunity to apply their education to a project and produce something meaningful. Experience has shown this motivates them to pursue advanced degrees. In addition, the program provides career awareness or a pipeline to the ASCI Initiative while also exposing the students to state-of-the-art problems and challenges while still in the classroom.

Additional components of the collaboration may include mentoring, Academic Excellence Workshops, distance learning, guest speakers/lecturers, seminars, and tours – including in a field. Summer students will be recruited from recommendations of the 386 Jr. Capstone faculty, participants in the ASCI-PALS (Pathways Leading to Success) program, and general recruitment efforts. Applicants will then be matched to potential projects with ASCI researchers for summer employment.

Partners

Laboratory:

- Accelerated Strategic Computing Initiative
- Defense & Nuclear Technologies and the Computation Directorate

Non-Laboratory:

- Northern Arizona University
- University of Utah/CSAFE
- IBM Corporation

Objectives and Metrics

- Help to ensure a highly-skilled, diverse workforce consistent with science and technology needs within DOE Defense Programs mission and goals.
Metrics: Determine the number of students who pursue graduate degrees in ASCI at an alliance school or ASCI careers.
- Advance the use of the Internet, computer science, and simulation technologies to introduce students to DOE's work with a special emphasis on national security relevant disciplines.
Metrics: Pilot the 386 Jr. Capstone course across multi-disciplines at NAU; determine the quality of the student learning as evaluated by the 386 faculty.
- Enhance national security and civilian scientific and technical literacy, with appropriate appreciation for and sensitivity for the cultural diversity within the community, state, and nation.
Metrics: Evaluate the quality of the student responses as observed by DOE Defense Program and LLNL ASCI personnel during the final presentations.

FY00 Accomplishments

- In late November, Northern Arizona University faculty notified the STEP staff of the topic selected for course EGR 486 (1999-2000 school year). The title was "Design Evaluation and Operational Control of Anaerobic Sludge Digester Mixing Using Circulation Time Distribution Theory." NAU faculty continued to refine the syllabi for this topic during the December holidays. The result was not clear until January 2000 that there was no potential collaboration with LLNL.
- As an alternative, funding from the project supported the Internships in Terascale Simulation Technology Tutorial Lecture Series. Based on inquiries to the ASCI/ASAP centers – specifically from Prof. Michael T. Heath, Director, Center for Simulation of Advanced Rockets and Computational Science and Engineering – the following uses for an ITST Lecture Video series were determined:

Continued on next page

FY00 Accomplishments *continued*

1. The lectures would be useful for independent, self-study by students in the Computer Science Engineering (CSE) program (and similar programs elsewhere). The CSE students span a fairly wide range of experience and sophistication, and include students from both CS and from applied fields. Such students would likely want to choose from among the lectures according to their individual interests and backgrounds.
2. The lectures would be useful as supplementary material for one or more of the courses in computer science that focus on parallel computing, of which in their program there are three – one on parallel programming, parallel architectures, and parallel algorithms.

It was felt that the videos would be valuable supplements, primarily for viewing outside normal classes.

3. The lectures would be useful in the training and outreach activities of an organization such as the National Center for Supercomputing Applications (NCSA).

Further inquiries indicate that the ASCI/ASAP centers are already quite sophisticated users of parallel systems. However, other academic institutions not involved with the ASCI/ASAP centers would be extremely anxious to have access to some form of these lectures.

Following the review and release of the video tapes, the appropriate format will be determined and a small quantity produced for distribution.

Evaluation/Assessment

Evaluation and assessment will be determined by the demand of such a product on a pilot basis. Further evaluation and assessment will be established contingent on the continuation of the effort. Recent assessment from the Center for Applied Scientific Computing (CASC) management is that future topics and presenters will more aggressively recruited instead of being voluntary with random topics.

Section 2 – Student Outreach

STEP Contact: Dick Farnsworth, (925) 422-5059, farnsworth1@llnl.gov

Introduction

The Science & Technology Education Program is the Laboratory's primary resource for K-14 students, teachers, and faculty. STEP science outreach activities and educator partnerships are funded by the LLNL general and administrative (G&A) budget.

STEP encourages pre-college students to consider a college education as part of their future career choices. These pre-college science outreach activities play an important role in the creation of future scientists, engineers, and technicians, especially those of special interest to LLNL.

Through local and regional education partnerships, STEP leads the Laboratory's education efforts to stimulate greater interest in science and technology among teachers and school administrators. Many of the new partnerships with the K-14 education community are being accomplished through memorandums of understanding and memorandums of agreement with the various University of California campuses. These activities are described in Section 3.

STEP responds to requests received by the Laboratory that are related to the science education needs of surrounding schools. STEP maintains a database of employees and their related areas of expertise in order to provide LLNL volunteers for education activities within the local communities.

STEP's science outreach and educator projects during FY00 engaged 9,000 students in the following projects:

Classroom/Career Days Speakers Bureau

When LLNL receives requests related to science education outreach endeavors, the requests are forwarded to the Science and Technology Education Program. STEP maintains a database of employees who have volunteered to provide presentations and lectures upon request, along with their areas of expertise. The majority of the requests are for speakers in the classroom or for major school events, such as career day.

Examples are the DOE-OAK Energy, Science and Environment event held each year in October at the Oakland Federal Building; the San Joaquin County Science Day in the spring; the UC Davis Career Day in the fall; and the Optics Family Day at UC Davis Department of Applied Science, Livermore campus in the spring. In each of these events, STEP shared its science and technology resources derived by LLNL to raise public awareness of the importance of science in our lives and the many career opportunities to available to students choosing to prepare for technical careers.

Crystals for the Classroom

URL: <http://education.llnl.gov/crystals/>

A consortium of science educators and research scientists – including chemistry faculty from the San Ramon Unified School District, Diablo Valley College, Contra Costa College, and scientists from the Lawrence Livermore National Laboratory – came together with the aim of developing science and technology instructional tools for chemistry teaching. The impetus for this collaboration was the intent to improve high school and college chemistry teaching and student learning so that students would be drawn toward chemistry, rather than avoid it.

The contribution of this consortium was to develop teaching tools for the classroom framed within a context of important, nationally-publicized science and technology issues. This would add relevance to basic science at the high school level within a team-based learning environment. This integrated approach to instruction would enable students to make connections between the classroom and real world applications of science. It would also help students to develop the critical thinking skills needed to explore complex issues related to chemistry within a larger scientific perspective.

The Crystals for the Classroom project makes use of “cutting-edge” rapid-growth crystal technology developed at LLNL as part of the National Ignition Facility laser project. The goal is to help students learn basic chemistry principles, develop laboratory and critical thinking skills through answering research questions and addressing goal-based challenges.

One of the consortium scientists from LLNL, Dr. Natalia Zaitseva, developed a rapid-growth crystal technique while she was a professor in Russia in the late 1980s. She has been a key collaborator and adviser on the project.

The consortium’s scientists and science educators have demonstrated that the state-of-the-art, rapid-growth potassium dihydrogen phosphate (KDP) crystal technology developed at LLNL can be successfully transferred to high school classrooms.

The San Ramon Valley School District (SRVSD) collaborated with LLNL scientists to initiate the Crystals in the Classroom project and determine if students could benefit from this technology. In 1999, SRVSD funded a high school chemistry teacher to work in an LLNL research laboratory. She learned to use the rapid-growth KDP crystal technology and contributed to the design of a prototype classroom crystal growing chamber. LLNL then donated the prototype crystallizer to SRVSD and mentored the teacher as she integrated this process into her high school and advanced placement chemistry curriculum.

During the 1999-2000 school year, high school chemistry students grew KDP crystals weighing approximately four pounds in five days. These students developed the chemistry skills and knowledge required by the California Chemistry Content Standards for grades 9-12 for a number of basic chemistry concepts and topics by growing KDP crystals while

gaining an understanding of how chemistry contributes to creating new materials to solve real-world problems. The content learned by the students included:

- Chemical, and physical properties of matter
- Conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants
- Solutions are homogenous mixtures of two or more substances, and
- Chemical equilibrium

Crystal-growth technology has much broader possibilities beyond the high school application. The Crystals in the Classroom project is being extended to community college chemistry students. These students will use the original LLNL experimental crystal research data to develop an expandable and querable database that includes the composition and concentrations of the starting solutions and the optical performance of the resulting crystals. Using this data, a plan for crystal growth using various doped starting solutions will be developed in concert with the high school students using the Internet. The college students will test the starting solutions using Atomic Absorption Spectroscopy and wet bench methods and post the analytical results to the Web.

The high school students will grow the crystals and send samples to the colleges to test crystal performance using UV-visible absorption. This approach will allow students to analyze results from their own predictions and deduce the impact of changes in concentrations and growth protocols on crystal structure and optical performance within the context of a highly important national multidisciplinary energy project that involves mathematics, physics, chemistry, computing and engineering. In this way students will learn and apply research skills while conducting student-centered research. The LLNL- and student-research data will be made available for educational uses and the project will operate through an Internet Web page developed and maintained by chemistry faculty at Diablo Valley College (DVC), Pleasant Hill, California, using a server supported by the LLNL Science & Technology Education Program.

To meet the goal of improving chemistry instruction, this project will disseminate the technology required to use these teaching tools through teacher professional development workshops. The SRVSD and LLNL will provide training and mentoring to enable high school teachers to use this cutting-edge technology. Initially, the workshops will focus on schools in the vicinity of LLNL. In subsequent years, the training will be offered to schools throughout the United States. DVC and LLNL will operate a Web site and provide instruction enabling students to access and use the querable database.



This project has received recognition for the contributions it is making to science education. In May 2000, Congresswoman Ellen Tauscher visited LLNL to acknowledge the science professionals who have developed this technology for use in classrooms.

Student at Monte Vista High School, within the San Ramon Valley Unified School District, works with the crystal growth chamber.

Expanding Your Horizons (EYH)

URL: <http://education.llnl.gov/eyh/>

Expanding Your Horizons conferences are one-day events for young women, grades 6-12, designed to encourage them to consider careers in math and science-related fields. EYH depends on volunteers who act as enthusiastic role models. The conferences offer hands-on activities and promote the importance of science, mathematics, engineering, and technology. Two of the three annual conferences are conducted in areas that have a large population of underrepresented students. EYH places a heavy emphasis on encouraging their participation.

During this year, STEP contributed hands-on workshops in optics and robotics to introduce students to technology that contributes significantly to their lives and provides an introduction to potential careers in those fields.

Three conferences were held serving three California counties: Alameda, Contra Costa, and San Joaquin. An estimated 1,400 students and 30 LLNL employee volunteers participated in the three events.

San Joaquin	600
Tri-Valley, San Ramon	400
Mills College	400

Explorer Post

The Science and Technology Explorer Post 957 is under the “career awareness” auspices of the Boy Scouts of America. The Post is “chartered” by STEP at Lawrence Livermore National Laboratory. Members consist of college-preparatory high school students who work on “projects” such as Web page development, Excel spreadsheets, and fiber optics demonstrations. Some LLNL volunteers act as advisors to the students on these projects while others provide training, project demos, and tours for the Explorers. Recently, these Explorers began learning to use optics and lasers as a part of their experience. The goal of the program is to encourage the members to stay focused on pursuing a college education by providing opportunities for students to work on projects related to their areas of study and interest.

The students completed projects during the course of the year. These projects included developing individual Web pages, conducting optics experiments, and designing a magnetometer. A total of 49 students and five LLNL employee volunteers participated in the Explorer Post events.

Fun With Science (FWS)

URL: <http://education.llnl.gov/fws/>

Informal, hands-on science experiences for students, teachers, parents, and public groups are offered through the Fun With Science program. Activities are conducted by a number of volunteers from various disciplines within the Laboratory. These activities seek to encourage and motivate students' interest in the sciences. This program addresses requests from educators and the public for science-related presentations in the classroom and at community events. It introduces the participants to how science and technology play a significant role in their lives. Presentations are centered on Laboratory expertise in areas such as lasers, energy, and chemistry.



Elvis Spencer, LLNL technician, conducting science demonstration with elementary school students as part of Fun With Science

The demonstrations are presented to support elementary school science teaching as required in the California state science standards.

Fun with Science conducted 28 demonstrations with an audience of about 4,000 students and teachers. More than 60 LLNL employees were registered as presenters to conduct Fun With Science demonstrations.

Future Scientists and Engineers of America (FSEA)

URL: <http://www.fsea.org/>

Future Scientists and Engineers of America has been in existence for seven years and is based in southern California. It is a national non-profit organization that provides the structure, project material, documentation, and workshop training necessary to establish after-school technology clubs. The program is structured around scientists mentoring a classroom of students (grades 4 through 12) on a project chosen by the scientist.

STEP supported 50 students from five different schools who chose to participate in Future Scientists and Engineers of America. In addition, five LLNL employees volunteered to provide technical assistance to each of the schools.

Math Challenge

URL: <http://education.llnl.gov/mc/>

This event, co-sponsored by STEP and the DOE Oakland Operations Office, is designed to encourage students' interest in math. It also seeks to support the goal of the 1989 Governors' Summit that U.S. students would be first in the world in science and mathematics. Each school participating in the Math Challenge may send up to five teams

of three students to participate. Scores are added; then the teams placing first, second, and third receive plaques honoring their achievement, while individual participants receive certificates of participation.

The annual conference was held at LLNL in the summer of 2000. Fifty students and five LLNL employee volunteers participated in a series of math activities using puzzle solving as the basis of student learning.

Science on Saturday (SOS)

URL: <http://education.llnl.gov/sos/>

Science on Saturday is a weekly series of free lectures and demonstrations intended for students, 6th grade through high school. The topics are selected from the forefront of science and technology research in a variety of disciplines. The goal is to allow students to interact with well-known scientists and engineers in the hopes of increasing the numbers who pursue careers in science and technology. These presentations are co-sponsored by STEP and the LLNL chapter of the Sigma Xi Research Society.

Six lecture demonstrations were conducted with an estimated 1,500 students participating. The topics selected from the research conducted at LLNL included:

Earth and Meteor Encounters

Described what we know about gravity, where it comes from and why it's important to life on Earth.

Crystals in the Classroom

Described how the cutting-edge rapid growth crystal technology was developed to produce optics materials for the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory, and how it is being used to help teach chemistry in high school classrooms.

Optics Engineering in the Information Age

Explored how lasers operate and how they are used in common devices such as CD players and telecommunications equipment.

Diet and Cancer, How Cooked Meats Might Be Involved

Explained how trace amounts of carcinogens can form in meat during the cooking process. They will also discuss what can be done to reduce the level of carcinogens present in cooked meat during their presentation.

Impacts of Impacts

Discussed how the Earth has been bombarded repeatedly by meteorites large and small, and that there is a small but genuine risk that a large asteroid may hit the Earth during our lifetime.

Global Digital Mapping

Discussed how technology is used to create interactive maps of the earth and how this information directly impacts our lives.

Student Research Academy

URL: <http://education.llnl.gov/sra/>

STEP developed a strategy to introduce research methods into the classroom. During this summer academy students and their teachers learn how to conduct research. They study with LLNL researchers and teachers already experienced in guiding student research. The Academy provides the student and their teacher with an opportunity to develop an appropriate research question, conduct the literature search and develop a research plan with appropriate experimentation. Under the direction of their teachers, these students complete their research investigation during the school year. During the winter these students return to LLNL to present their work in a student research symposium hosted by STEP at Lawrence Livermore National Laboratory.

Tri-Valley Science and Engineering Fair (TVSEF)

URL: <http://lasers.llnl.gov/lasers/tvsef/>

The Tri-Valley Science and Engineering Fair is a science project competition for students, grades 7-12, from public schools within the areas of Danville, Dublin, Livermore, Pleasanton, San Ramon, and Sunol. The fair is affiliated with the Intel International Science and Engineering Fair. The STEP director, Don Correll, has been the committee chair of the Fair's Science Review Board since its inception.

More than 200 students submitted projects to the fair. The fair was attended by an estimated 400 guests and 20 LLNL employee volunteers. The fair winners competed in the National Science Fair held in Washington, D.C.

Section 3 – State of California and University of California K-14 Education Partnerships

STEP Contact: Dick Farnsworth, (925) 422-5059, farnsworth1@llnl.gov

Introduction

In FY00, STEP continued to expand its community and regional education activities to include a larger representation from the entire state of California. Natural partners for this expansion are community colleges, state colleges, and University of California campuses. During FY00, the STEP K-14 projects engaged over 1,200 teachers.

Edward Teller Science and Technology Symposium

The Edward Teller Science and Technology Symposium provides a bridge between the science classroom and the research laboratory. STEP, University of California-Davis, Department of Applied Science, and the Sigma Xi Research Society are providing secondary and community college science educators with the opportunity to explore ongoing research at LLNL.

One-hundred-twenty science educators from schools and colleges throughout California participated in the Symposium. Each participant was assigned to one of the four content groups based on their teaching interest: physics, chemistry, biology or environmental science. Within each of these content themes, LLNL research sites were selected to be the focus of the symposium.

During the symposium, the participants toured state-of-the-art research laboratories related to their interest, where they talked with researchers about their work, listened to address by Dr. Edward Teller, and enjoyed a “Dinner with a Scientist” event. During the dinner event, they heard Nobel Laureate Dr. Steven Chu, of Stanford University, talk about his research.

Each participant attended three “hands-on” workshops to learn new activities to be used in the classroom. These lessons and activities were developed to link directly to the California Science Education Standards. These lessons and activities included:

Biology focused on biotechnology

This group explored various processes of recombinant gene expression and protein purification. Participants isolated Green Fluorescent Protein (GFP) using the Bio-Rad Biotechnology Explorer purification kit.

Environmental science focused on radiocarbon dating

Participants learned the basics of radiocarbon dating in a lecture setting and where it fits into the California Science Standards. They participated in problem-solving activities where they interpreted actual ^{14}C data sets from volcanic eruptions and earthquake faults to determine the dates of the activities. Supporting documents will be provided such that all of the activities will be of immediate use in the classroom.



Participants in the biotechnology workshops isolated Green Fluorescent Protein (GFP) as a part of the process of recombinant gene expression and protein purification experiments.

Chemistry as applied to conduct water quality sampling and data analysis, evaluating the fate and transport of chemicals found in common herbicides

They conducted field studies, examined methods of monitoring the environment through chemical analyses, discussed why monitoring is important, and how to determine the parameters that are most important for tracking. The session ended with a discussion on the implications of “high tech” monitoring, the ability to detect compounds at lower levels than were previously available to be tracked and the impact this new technology can have on industry through stricter legislative requirements.

Physics – how opto-electronic technology is used to transfer data through LCD (liquid crystal display)

The physics group explored how the LCD is a combination of simple optical components (polarizer, quarterwave plates, birefringent crystals) which can be controlled by simple electronics, allowing the visual transfer of information in such instruments as: Palm Pilot interface screen, digital watches, and laptop computer screens. This group built an inexpensive, functional polariscope, examined a simple LCD display commonly employed in a calculator, and constructed a working LCD display comparing its function to a commercially manufactured device.

Each participant was given a set of materials containing the activities and slides used in the workshops for their use in the classroom. A CD-ROM was developed containing images of the tours of the laboratory facilities and all of the materials used in the workshop.



Of those completing the program evaluations, 100% rated the experience as “well worth their time to participate.” Approximately 80% felt they “received materials they could use in the classroom” and indicated that “these materials were not available to them in the text book.”

Environmental scientist Dr. Andrea Cook and high school science teacher Stan Hitomi from Monte Vista High School, San Ramon Valley Unified School District, examine core samples used to date volcanic activity in Greenland.

Internet Technology Computer Classes

(previously known as the Technology Research Center)

STEP offers Computer Technology Workshops for educators, which prepare teachers to use the computer as a tool to access information from the Internet. These courses have been designed by educators for educators. The course designers and instructors are experienced science and mathematics teachers who have successfully integrated computer technology into their curriculum. These teachers developed their skills under the mentorship of a computer scientist while working at the Lawrence Livermore National Laboratory, and currently apply their craft at a “Digital High School.” They designed each workshop in an effort to pass along their success to other classroom teachers.

The workshops are built on a “hands-on” approach to learning. The workshops allow the participants learn through their own work experience. The participants generate “products” during the classes to be used in their classrooms. These workshops are accredited by the University of San Diego, to allow participants to earn college course credit. The courses meet or exceed the requirements for “Digital High School” credit, a California initiative to prepare high school teachers to effectively use the Internet.

Twenty-three workshops were conducted with approximately 250 participants. They completed entry-level workshops such as Introduction to the Internet, Finding Educational Resources on the Internet, and Beginning Building Web Pages. Advanced courses in Adobe Photoshop and interactive Web page design were conducted so that teachers could learn to develop Web resources to support their instruction. A complete list of workshop offerings is available at http://education.llnl.gov/workshop/WS_List.html.

Laser Science and Optics in the Classroom (LSOC)

The Laser Science and Optics in the Classroom program is a high school component initializing a school-to-career path leading to careers in laser science and optics. Teachers participating in LSOC receive materials and lessons to help them integrate laser and optics technology into high school science and mathematics curricula. LSOC lessons are activity-based, giving students hands-on experience using lasers and optics equipment. Professional development workshops were conducted with teachers in Merced and Fresno schools. These teachers have introduced optics into their existing curriculum where it matches the state science standard requirements.

Thirty high school teachers participated in LSOC instruction from Merced Unified School District. Later in the year several of their students presented demonstrations of their work using lasers and optics at a University of California at Merced meeting. These demonstrations illustrated how the optics materials are being integrated into high school science classrooms.



Students from Golden Valley High School, Merced Union High School District demonstrate their understanding of the principle of optics and light learned from a teacher who completed the LSOC program. The demonstration was conducted at the LLNL, UC Merced, and Merced College MOA signing.

University of California, Merced/Merced College

During FY00, STEP entered into three new education collaborations. Education activities were the focus of memoranda of agreement (MOAs) with

- University of California, Davis – Department of Applied Science (DAS)
- University of California, Merced
- Merced College

to help California schools improve the quality of science teaching.

In the UC Davis MOA, STEP agreed to share its education resources with the Department of Applied Science to leverage resources to achieve a shared goal of science and technology education outreach.

This led to a proposal to create a “Regional Education Center” (REC) for teacher professional development. This proposed collaboration would be jointly funded by the UC Office of the President (UCOP) and LLNL. The REC would be located on the DAS Livermore campus and would serve the K-12 teachers working in the greater Livermore Tri-Valley area and the San Joaquin Valleys.

The initial focus of the consortium will be science and technology instruction. The Center will assess the member districts to establish science and technology faculty needs and provide developmental opportunities to serve the needs of the teachers. The science and technology focus uses the close proximity the “world class” scientific resources available at LLNL and the existing professional development outreach programs currently available from the LLNL Science and Technology Education Program. The goals for the REC include:

- Increase student performance in science and technology education.
- Provide professional development for all K-12 teachers throughout their teaching careers.
- Use the resources of the consortium to strengthen proposals submitted by its members.

This collaboration will also include other education institutions beginning with the Lawrence Hall of Science and the Carnegie Foundation CASTLE program, as well as industry partners. STEP will use the teacher development center resources and facilities to conduct its workshops for years to come and will leverage the power of this center to be a part of other education funding proposals.



(From left) Dr. Ben Duran, president of Merced College, Dr. Bruce Tarter, director of Lawrence Livermore National Laboratory, and Dr. Carol Tomlinson-Keasey, chancellor of UC Merced, sign a Memoranda of Agreement to invest their resources to improve science and technology education.

Timeline

January 2000	STEP – DAS drafts a Memorandum of Understanding collaboration agreement
March 2000	STEP locates computer equipment at DAS
May 2000	STEP – DAS conduct parent – student workshops for optics careers
May 2000	STEP – DAS and UC Merced submits letters of intent to submit proposal for the <i>California Subject Matter Projects</i> for science improvement
June 2000	STEP begins conducting teacher development instruction in computer internet technology at DAS
July 2000	STEP – DAS offers the Student Research Academy for high school students
August 2000	UC Merced, Lawrence Hall of Science, and Carnegie Foundation agree to participate as partners in Science and Technology Teacher Learning Center
August 2000	UC Merced funds “teacher in residence” at LLNL to support teacher workshops

LLNL signed a MOA with UC Merced to promote science teaching and student achievement in science and technology. STEP at LLNL was a catalyst in establishing the education components associated with this agreement.

The Science and Technology Education Program began partnering with the UC Merced to conduct professional development instruction with schools and districts in the San Joaquin Valley. This ongoing relationship lead to the submission of a California Subject Matter Projects grant proposal for the improvement of science teaching on behalf of UC Merced, with STEP staff as a co-principal investigator.

STEP staff has an expanded advisory role in several of the UC Merced outreach efforts including the Merced County College Bound Consortium (MCCBC), the community Teaching Fellowships in Mathematics and Science (CTFMS), and the Promoting Achievement Through Hands-on Science (PATHS) project.

The purpose of the MCCBC is to improve science and technology learning opportunities for students in Merced County. CTFMS creates a consortium to increase the number of science and math teachers in the Central Valley and PATHS provides elementary school teachers with hands-on science curricula and training.

STEP brokered a MOA with Merced College (MC) to create advancements in technical education in the Central Valley. This MC technical education program has resulted in a Merced College Technical Institute (MCTI). MC administrators and faculty, working with STEP staff, are identifying resources and expertise available at LLNL that can be used to assist MC in developing “state-of-the-art” technical certificate programs.

The curricula are designed to prepare students for careers in a variety of fields, including laser and electro-optics, biotechnology, geographic information systems, advanced manufacturing, and information technologies.

The graduates from these programs will be qualified to enter the technical workforce or continue their education at the University of California, Merced campus in pursuit of advance technical degrees.

Skilled graduates are expected to have qualifications sufficient to qualify for employment at LLNL in a variety of classification, including entry-level laser electro-optics technicians (LEOTs), biotechnology technicians, and information technology technicians.

Section 4 – LLNL Institutional Education Activities

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Introduction

In addition to the student internships, education outreach, and University of California education initiatives (as described in the previous three sections), STEP plays an institutional role in defining, organizing, and sometimes leading many of the Laboratory's activities in support of its broad education goals (<http://www.llnl.gov/llnl/001index/03ed-index.html>).

STEP makes available to student interns a number of venues to help them further their studies and their career goals besides their research experiences within the Lab's mission-based sciences. For example,

- Information on scholarships and grants
- Networking with other student interns
- Preparation for the Graduate Record Examination
- Institutional lectures and seminars

STEP also provides ways that help student interns to adapt to LLNL culture. For example:

- Student Bulletin Board
- Panel discussions, e.g., this year on "Women in the Workforce"

The Student Bulletin Board (<http://education.llnl.gov/sbb/>) is an online bulletin board where students can interact on a social level. Here students can learn about the lecture/seminar schedule as well as social activities. Students can also connect for events and activities in the Bay Area region and beyond.

On the Student Bulletin Board, interns can find out about scholarships and other funds that are available. The page is also linked to the 2001 Colleges, College Scholarships, and Financial Aid Page at <http://www.college-scholarships.com/>

STEP leads the LLNL Institutional Education Committee to integrate many of these Laboratory education venues with the LLNL research programs that have student interns. STEP has also partnered with the California Cooperative Education Association (<http://www.ca-co-op.org/>) to provide a link between the Lab's workforce needs and those of the State of California.

A highly regarded activity of STEP – in helping the Laboratory support of the common goals of the DOE and DoD – is ROTC day for both high school and college cadets. Linked to the ROTC program is an initiative to link JROTC programs with the model developed for the former Critical Issues Forum project. STEP is working closely with the Center for Nonproliferation Studies at the Monterey Institute of International Studies in support of its Critical Issues Forum (<http://cns.miiis.edu/class/hsout/>).

Section 4 details these additional institutional activities managed by STEP.

California Cooperative Education Association (CCEA) and Associated Western Universities

URL: <http://www.ca-co-op.org/>

STEP has been involved with new partnership developed between the California Cooperative Education Association (CCEA) and the Associated Western Universities (AWU). Both organizations are non-profit consortia of colleges and universities working to increase student and employer participation in work-based learning programs.

Internships and co-op programs help science, engineering and math students to graduate from college. These programs not only allow students to raise tuition dollars needed to stay in school but also help students achieve academically, by increasing their understanding of classroom learning. A 1996 study by the American Council on Education noted that, among the 500 colleges and universities surveyed, those that offered paid internship and co-op experiences reported the greatest impact on both financial assistance and academic gains for students.

STEP has been supporting the efforts of these organizations by hosting the office of the AWU/CCEA Partnership Director. After the first year of this collaborative effort, several new internship and co-op programs have been launched, serving students at a number of colleges and universities in California and the Western states.

Below are just two examples of programs being coordinated by this office:

The Virtual Internship and Co-op Fair

URL: <http://www.awu.org/internfair>

The Virtual Internship and Co-op Fair (VICF) is an Internet job fair focusing exclusively on internships and co-ops for science, engineering, technology, computer, and business students. The inaugural event, held in April 2000, drew 7,000 student participants from more than 40 colleges and universities in the Western states. More information about the VICF, the next event, and the list of participating colleges and universities can be found at the Web site listed above.

Virtual Team Co-op Model

URL: <http://www.awu.org/sun/default.htm>

A Virtual Internship Program was successfully piloted during spring 2000 by:

- Sun Microsystems
- California State University, Sacramento
- California Cooperative Education Association
- Associated Western Universities

Responding to a record number of student applicants, the computer science faculty at CSU, Sacramento helped select and assign student teams to a semester-long project provided

by Sun Microsystems. Students set their own hours and did not have to leave campus. By the end of the semester, the students had exceeded expectations. With guidance from faculty and Sun managers, the student teams produced creative, usable solutions on time.

The program is being expanded to include four projects sponsored by Sun during fall 2000 and Hewlett-Packard will add projects during spring 2001.

Intel, IBM, and several smaller companies have expressed an interest in providing projects, and many additional universities have expressed an interest in hosting these projects.

Traditional co-op models prevent many students from participating because they cannot afford to commute or they cannot afford to take the time out of class schedules. This new “virtual” co-op model removes these barriers allowing more students to benefit from internship and co-op programs.

Motivating Students to Pursue Graduate School

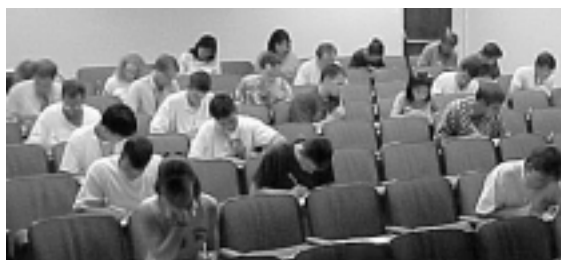
A number of individual activities were planned in FY00 to motivate students to pursue their graduate degrees. These included free downloads of the GRE PowerPrep software (a site license acquired by STEP) and a Kaplan Associates sponsored GRE Pretest and feedback strategy session. STEP obtained a site license for this software. Out of 100 copies available, 91 were downloaded for use.

On a more informal level STEP scheduled guest speakers Dr. Collette Patt (UC Berkeley, Director, Physical Sciences Student Diversity Programs, Dean's Office – Letters and Sciences) and Dr. R. Noe Lozano (Stanford University Associate Dean for Student Affairs and Director of Engineering Diversity Programs). Both spoke about graduate school admissions. Additionally, Bo Hammer (Director, Society of Physics Students, American Institute of Physics) gave a presentation regarding the myths that there are no jobs in physics.

Input from summer student participants indicated that these opportunities and programs were very helpful. Comments included, “I would not have known how to prepare for the GRE otherwise” and “because it was helpful to have someone explain the process of deciding to go to graduate school.”



Collette Patt, Ph.D., director of the Physical Sciences Student Diversity Programs, Dean's Office – Letters and Science, UC Berkeley, dispels misinformation about graduate school applications and admission.



Undergraduate summer students had an opportunity to see how they would score on the Graduate Record Exam (GRE) with the help of Kaplan, Inc., a test preparation company.

In addition, students could test themselves, at their own pace, through a software program called GRE PowerPrep.

LLNL Institutional Education Committee (IEC)

Lab employees who are involved in facilitating student hands-on experiences have pooled their limited and constrained resources to participate on a new committee, the LLNL Institutional Education Committee (IEC), facilitated by STEP personnel. Recent participants have come from (but were not limited to):

- Affirmative Action and Diversity Program
- Biology and Biotechnology Program
- Energy Directorate
- Engineering Directorate
- Environmental Protection Department
- Environmental Restoration Division
- Geophysics & Global Security
- Health & Ecological Assessment
- Human Resources
- Materials Research Institute
- Operations & Regulatory Affairs Division
- Physics Directorate
- Science & Technology Education Program
- University Relations Program

Members on the IEC have provided input to the development of the electronic student bulletin board and have facilitated the various seminars, tours, brown bag lunches, socials and women's panel as described previously.

LLNL hosts approximately 400 to 500 students at LLNL to support research projects. These students range from the exceptional high school student to graduate students and post docs. With this variety in age, disciplines, academic background, etc., we recognize that a broad program is needed to address the diversity of interests. The IEC have pooled their resources to provide such a program. A research experience is highly valued, but if the student is isolated, it can still be a poor experience. In the end, comments from students, like "My whole experience was a wonderful one. It has made me seriously think about graduate school and doing more research work" make all the effort worthwhile.

In addition to institutional support for students, STEP's efforts continue toward the Chiles Commission and building a pipeline to support LLNL recruitment efforts. This support has resulted in requests for STEP personnel to serve on Laboratory committees. STEP staff have participated on a Business Services advisory board to assess management

practices (called the Gauge Model), a Human Resources subcommittee to update the summer employment Web page and a subcommittee to update the Affiliate Policy worksheet.

Student Bulletin Board

The Student Bulletin Board (<http://education.llnl.gov/sbb>) offers lists of activities and lectures specifically for students, and provides information about scholarships and grants mentioned above. It is also a venue for participants to network with each other or plan weekend activities.

In FY00, there were 20 scheduled events (meetings, seminars, tours, etc.) with over 900 participants within the following major elements:

- | | |
|---|------------------|
| • Two brown bag lunches with Dr. Edward Teller | 80 participants |
| • Practice GRE test and feedback session | 47 participants |
| • ASCI speaker and ice cream social | 50 participants |
| • Center for Accelerator Mass Spectrometry Tour | 13 participants |
| • Two National Ignition Facility Seminars | 96 participants |
| • Graduate School Admissions speaker and BBQ | 125 participants |
| • Biological Terrorism seminar | 45 participants |
| • Hypervelocity Impact Studies speaker | 65 participants |
| • Careers with Physics: Dispelling the Myth | 15 participants |
| • National Atmospheric Advisory Center Tour (2x) | 26 participants |
| • Women's panel discussion | 250 participants |
| • How to create effective poster presentations (2x) | 40 participants |
| • Lab-wide student poster symposium | 30 participants |
| • Do Hamburgers Cause Cancer seminar | 20 participants |
| • Peregrine (advanced radiation treatment) seminar | 10 participants |



Dr. Edward Teller (head of the table) kicked off and closed the summer enhancement activities for students performing internships in the summer of 2000. Dr. Teller gave a brief lecture to a packed room of summer students, followed by questions and answers.



Ed Moses, project manager of the National Ignition Facility (NIF), presents a seminar about the development of the world's most powerful laser, to a packed auditorium of summer students.

Along with project specific seminars i.e., MARA and ITST, the above meetings were available to all students. The specifics of these seminars are in the Appendix 2 FY00 Report section. Links were included to the Military Academic Research Associates (MARA) briefings (http://education.llnl.gov/mara/MARA_schedule.html) and Internships in Terascale Simulation Technology (ITST) Lecture Tutorial series (http://education.llnl.gov/itst/itst_schedule.html) as optional lectures students might attend.

Student response indicated the Hypervelocity (meteorite) seminar was the most popular with the brown bag lunches with Dr. Teller, and the women's panel as close seconds. Anything "social" tended to also rate high. Students seemed to recognize this as a great way to learn about the multidisciplinary research going on at LLNL.



(Seated from right to left) "Decisions for Success" panel featuring Sandia Vice President Mim John, LLNL employees Ellen Raber and Judy Kammeraad, and KPIX investigative reporter Christi O'Connor. Panelists advise students and employees on how to shape success from dream and disappointment.

Women's Panel – "Decisions for Success"

This event featured LLNL employees Judy Kammeraad and Ellen Raber, Sandia Vice President Mim John, and KPIX investigative reporter Christi O'Connor. The panel was aimed at female employees and students at the Lab. A majority of the questions dealt with landing a dream job, dealing with disappointment, and finding a mentor. More than 200 women from LLNL and Sandia/CA turned out for this panel discussion to listen as the panelists, all successful women, shared the details of their lives and careers. Vice President Mim John closed the session by encouraging women to remain committed to chasing their dreams of success. "Don't abandon what's unique about you as an individual, or as a woman," she said. "You don't have to compromise – I never compromised to get to where I am."

Both students and employees have commended and complimented the Institutional Education Committee members, the Women's Association, and the Affirmative Action and Diversity Program, who partnered in hosting the event.

A video of the panelist discussion was made and is now available for loan through STEP. Because of the enormous response and positive feedback from the event, another is sure to be scheduled for FY01. We are also considering mini-panels that will focus on specific topics of interest.

Students On-The-Go

This is one of the most popular sections of the Student Bulletin Board. Students and faculty posted 32 weekend and weekday social and recreational activities.

- A's for \$1
- BattleBots tournament
- Salsa Lessons
- Racquetball!

- Dinner and a Movie: The Perfect Storm
- Indoor Rock Climbing
- Interested in playing tennis!?
- Windsurfing/seacycle afternoon or evening
- National Trails Day 2000 – Repairs to the Bay Area Ridge Trail
- Roller Coaster trips – Great American, Marine World, and Santa Cruz
- Trip to The Exploratorium Museum in San Francisco
- Let's get out of town . . .
- Swing Dancing
- Nature Excursion
- Lassen Volcanic National Park

A common thread of feedback was that this was very helpful to invite and encourage students to do social activities outside of work, especially when they did not know other students prior to coming to LLNL.

Roommate Matching

This was a new feature added in FY00 to help students in future summers identify potential roommates and reduce expenses for shared lodging.

Student News List

This mailing list is open to students and faculty participating in summer programs, internships, and other activities at LLNL. Subscribers are encouraged to use the list to network while at the Lab and to update their e-mail addresses when they leave. Announcements and other information of interest to visiting students are posted on this list. More than 165 participants registered.

Students indicated this was a good way to communicate to other students, to update students on new information, changes (time or location) to coming seminars, etc.

Military Academic Research Associates (MARA) ROTC Day

URL: <http://education.llnl.gov/mara>

All California ROTC detachments were invited to participate in the second annual Lawrence Livermore National Laboratory Spring ROTC Day on May 10, 2000. Approximately 43 cadets and midshipmen and their officers attended.

The Laboratory's ROTC Day has become a part of the Laboratory director's efforts to strengthen the relationship between LLNL and the Department of Defense. Lawrence Livermore National Laboratory and STEP are helping to shape the future workforce by leveraging the rich scientific and technical base of the Laboratory. ROTC Day is a component of STEP's Military Academic Research Associates program. MARA provides hands-on internship research opportunities to undergraduate cadets and midshipmen. MARA also offers opportunities to conduct thesis research and facilitates faculty research appointments.

This year's ROTC Day included a panel discussion on future careers in the military and the role that science and engineering will play. After the panel discussion, Dr. Edward Teller spoke and then joined the participants for a luncheon where they were able to ask questions

on an informal, yet personal basis. Following lunch with Dr. Teller, there were further briefings and in-depth tours to the following areas:

- Tour 1: High-Explosives Applications Facility and the National Ignition Facility (NIF)
- Tour 2: Chemical & Biological Non-Proliferation Program and of DoD Technologies
- Tour 3: Conflict Simulation Lab (to include the Joint Conflict and Tactical Simulation and the National Atmospheric Release Advisory Center)

Information on this year's ROTC Day, including the invitation, agenda, registration for the day and the tours, tour descriptions, and biographies can be found at the MARA Web site: <http://education.llnl.gov/mara>

General input from this year's event was universal: the cadets and midshipmen requested more time to absorb everything. Although students asked for a second day, it is more likely the next ROTC Day will be extended to a longer day.

Critical Issues Forum

URL: <http://cns.miis.edu/class/hsout/>

The goal of the Critical Issues Forum (CIF) is to involve high school and two-year college students and teachers in issues of proliferation and control of weapons of mass destruction.

Current CIF modules include:

- a) Proliferation, nonproliferation, and counter proliferation
- b) Disposition of nuclear materials, and
- c) Chemical and Biological Weapons

In addition to the content that is Defense Program oriented, CIF provides students with instruction and guidance in research methodologies, including brainstorming, evaluation, synthesis, and critical writing. CIF emphasizes strategies that can be used with the Internet. We involve scientists and other professionals from within the LLNL complex to ensure accuracy and appropriateness of content. As an adjunct to MARA, CIF provides JrROTC cadets important content knowledge that informs them in making their military career choices.

It is in the interest of both the DOE and the DoD to attract and train the future generation of analysts in national security matters. This is an area where the current generation is nearing retirement and there are few from academia who study these issues as part of their research agenda.

An example of the contributions that can be made by ROTC personnel is the project made by cadet intern, E. M. Martzen of Baylor University AFROTC. Cadet Martzen did high level research on theories of "Just War." He presented his work as background to the social/cultural thread of CIF at the summer planning workshop in Monterey. He also presented his research at the LLNL student poster symposium (see page 68). His final paper will be given to the teachers participating in the 2000-01 CIF winter conference in Monterey.

STEP presented CIF at the regional AFJrROTC quarterly meeting, resulting in two new schools for FY01.

Appendix 1 – FY00 Participants and Demographics

STEP collects demographic data in two broad categories:

- Stockpile Stewardship Student Research Internships
- Science Outreach and K-14 Educator Partnerships

In FY00, STEP also collected data in a category called National Security Internships. This program is similar to the Stockpile Stewardship Program except it is funded directly.

Within each category, we collect data for pre-college (direct and, where appropriate, indirect participation), undergraduate, and graduate participants. Direct participants¹ are those who attend classes, workshops, lectures, and other events, or who are interns at the Laboratory. Indirect participants² are those students who are affected by the faculty whom we engage directly in our programs.

In FY00, all Defense Programs activities were directed at undergraduate and graduate students and college faculty. Among the Science Outreach and K-14 Educator Partnerships activities, most were directed at pre-college students and faculty.

Below are the overall data for STEP.

	Pre-college Direct	Pre-college Indirect	Undergraduate Direct	Graduate Direct	
				Students	Faculty
Male	4,490	34,964	56	21	610
Female	4,485	35,983	22	13	617
Total	8,975	70,947	78	34	1,227

Of the 112 university students brought to the Laboratory, the Stockpile Stewardship Programs hosted 51 undergraduates and 27 graduates. Similarly, the National Security Student Internships Program hosted 27 undergraduate and seven graduate students. The National Security Student Internships program consists of students from the Associated Western Universities (AWU) and holdover students from the FY99 University Research Students (URS) program. The 1,227 faculty represent the Science Outreach and K-14 Educator partnerships.

In comparing the gender mix, if the undergraduate students from the Military Academies (mostly male) are not considered, the undergraduate gender ratio is 49:31.

¹ K-12 teachers are included within the direct graduate count, as they have completed at least one degree.

² The indirect pre-college participants were calculated using the following multipliers: elementary (K-3rd = 20, or 4th-5th = 30), middle school (125), or high school (150) factor – California State Department of Education statistics were used in calculating the indirect pre-college demographics (<http://data1.cde.ca.gov/dataquest/SearchName.asp?rbTimeFrame=oneyear&rYear=2000-00&Topic=Enrollment&Level=State&submit1=Submit>)

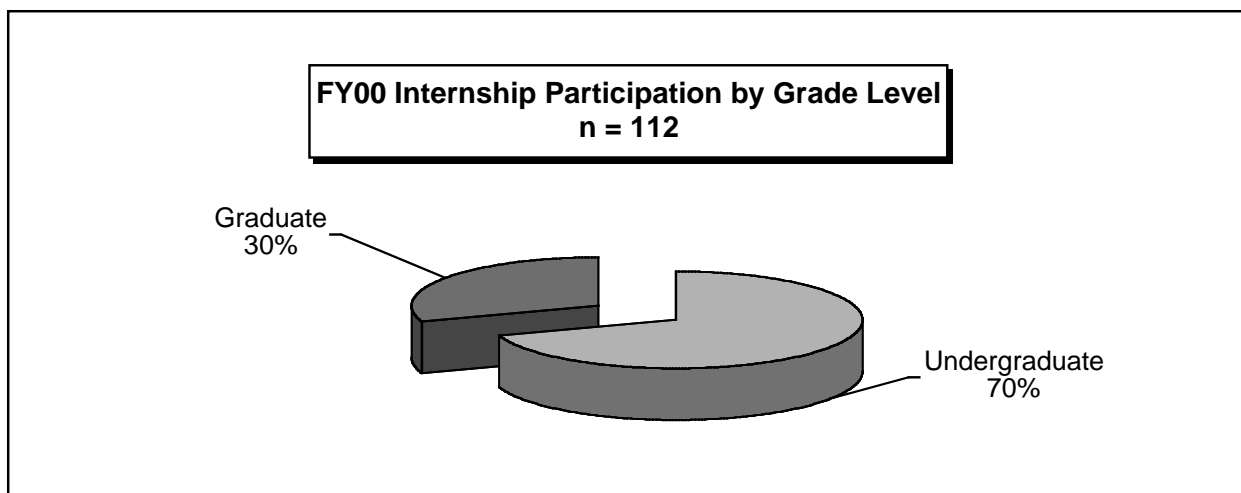
Student Research Internship Programs: Stockpile Stewardship and National Security

The following are data for Stockpile Stewardship Student Research Internship Programs.

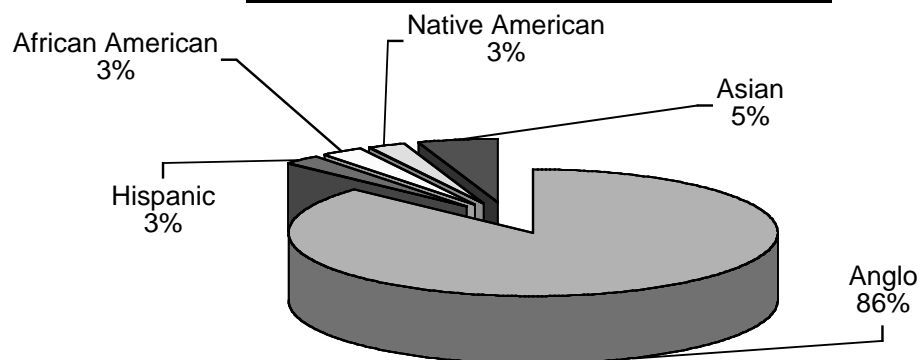
Accelerated Strategic Computing Initiative (ASCI) Pipeline at <ul style="list-style-type: none"> Northern Arizona University Cal-State University Hayward San Jose State University University of the Pacific
Actinide Sciences Summer School
Graduate Interns for Nuclear Technologies
Internships in Terascale Simulation Technology
Military Academic Research Associates <ul style="list-style-type: none"> Military Academies ROTC
System Administration Computer Support

	Undergraduate	Graduate
Male	56	21
Female	22	13
Total	78	34

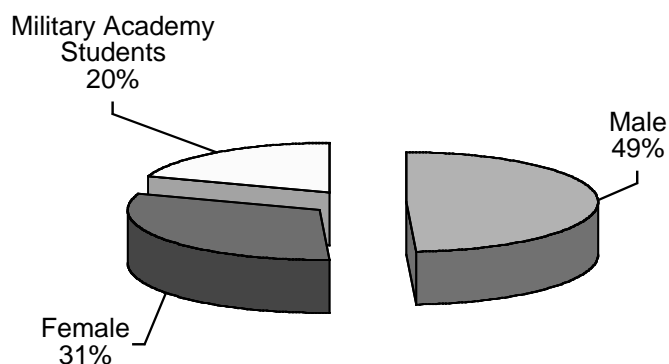
These data provide grade level and demographic information for the 112 Stockpile Stewardship programs above and the National Security Internship programs:



FY00 Internship Participants by Ethnicity
n = 112



FY00 Internship Participants by Gender
n = 112



Science Outreach and K-14 Educator Partnerships

Among the Science Outreach and K-14 Educator Partnership projects, most are directed at middle and high school students. They are usually one-day events, though some – like Science on Saturday – run in a series or – like the Explorer Post – meet weekly for a set period of time. Fun With Science is primarily directed at elementary school participants. Typically, the Educational Outreach Programs are funded through LLNL funds.

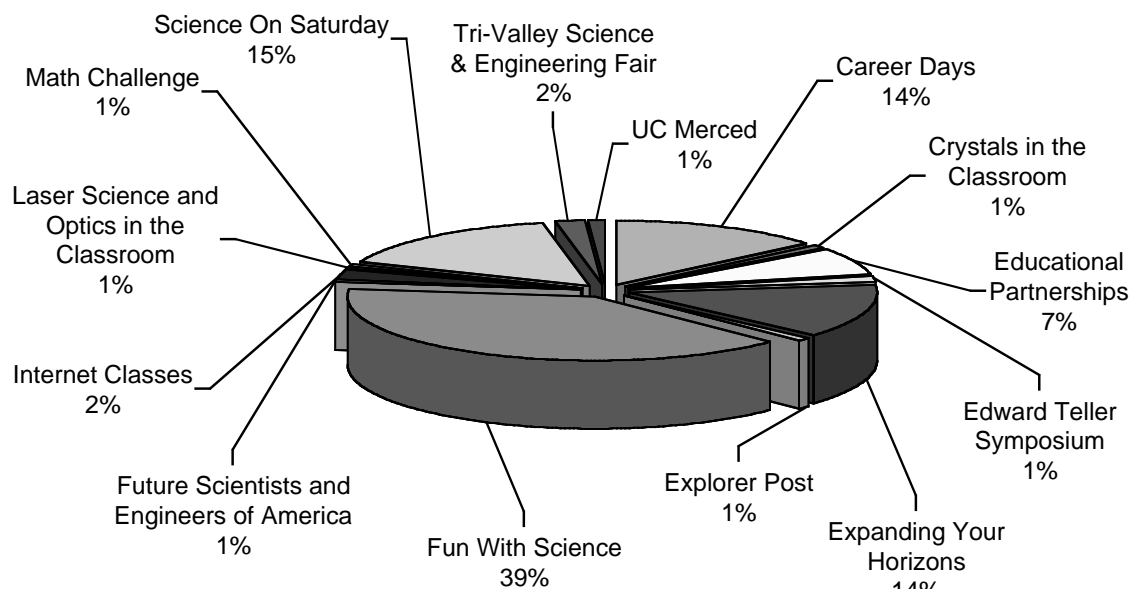
The Science Outreach and K-14 Educator Partnership projects are as follows.

Science Outreach (students)
Classroom/Career Days Speakers Bureau
Critical Issues Forum (students)
Crystals in the Classroom (students)
Expanding Your Horizons, EYH (three conferences)
Explorer Post
Fun With Science (FWS)
Future Scientists and Engineers of America (FSEA)
Math Challenge
Science on Saturday (SOS)
Tri-Valley Science and Engineering Fair (TVSEF)

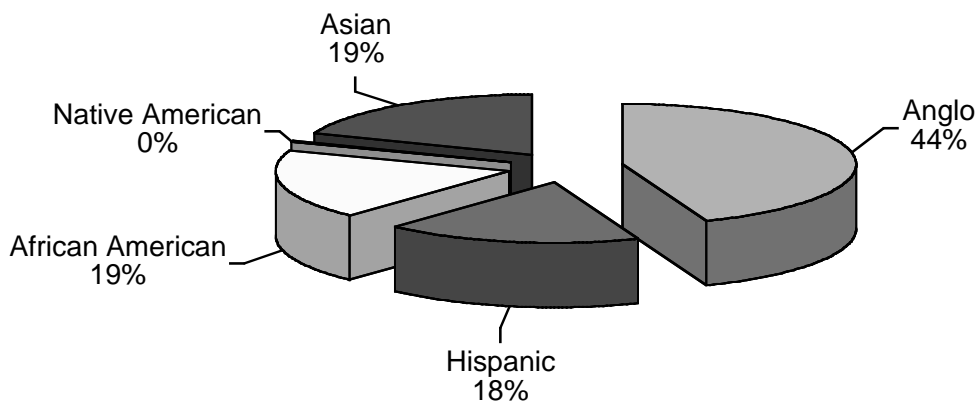
K –14 Educator (teachers)
Critical Issues Forum (teacher development)
Crystals in the Classroom (teacher development)
Educational Partnerships
Edward Teller Science Education Symposium
Internet Technology Computer Classes
Laser Science and Optics in the Classroom
UC Merced/Merced College School to Work

These data provide participation and demographic information for these programs:

**FY00 Outreach Participants
(Students and Teachers)**
n = 10,202

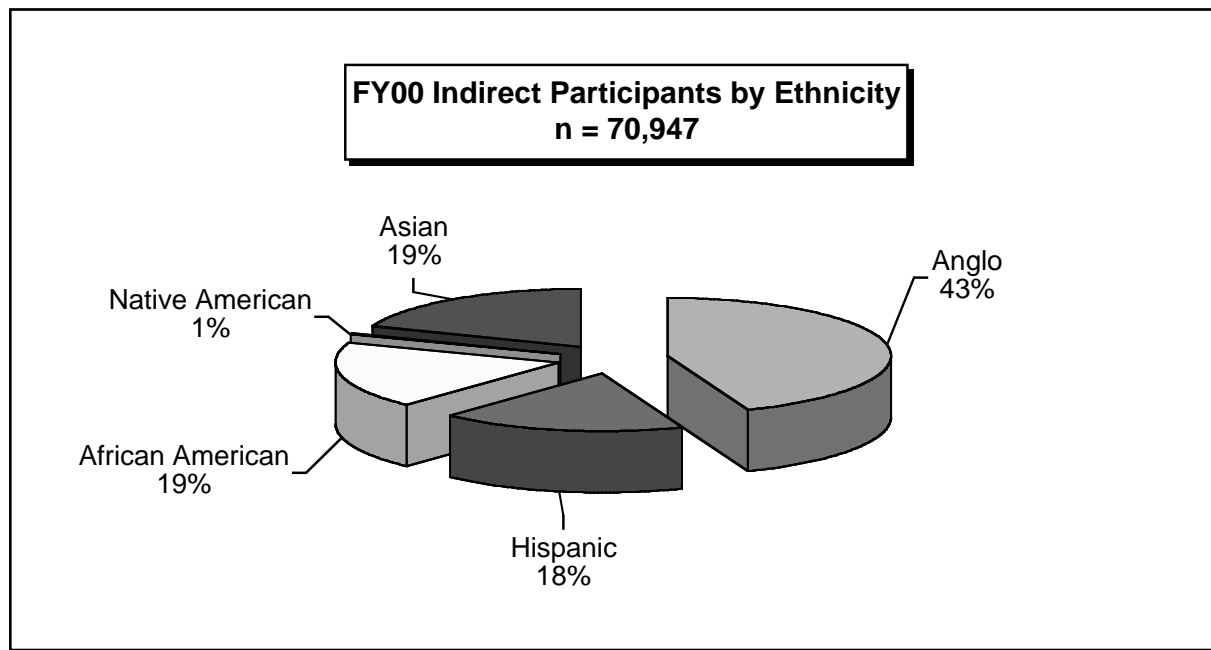


FY00 Outreach Teacher Participants by Ethnicity
n = 1,227



Recall that indirect participants are calculated using a formula³ to show how many children will be reached by the teachers in the direct count.

³ The indirect pre-college participants were calculated using the following multipliers: elementary (K-3rd = 20, or 4th-5th = 30), middle school (125), or high school (150) factor – California State Department of Education statistics were used in calculating the indirect pre-college demographics (<http://data1.cde.ca.gov/dataquest/SearchName.asp?rbTimeFrame=oneyear&rYear=2000-00&Topic=Enrollment&Level=State&submit1=Submit>)



Appendix 2 – Lecture Series and Workshops

In support of student internships, STEP plays a major role in helping define, organize, and sometimes lead many of LLNL activities to meet the Laboratory's broad education goals. In addition to their research experiences, STEP makes available to student interns a number of lectures and seminars to help them further their studies and their career goals. These events are all based the Laboratory's mission-oriented sciences.

Below are the instructional events offered to students working DP programs for FY00:

Actinide Sciences Summer School Program (ASSSP) Lecture Series

URL: <http://education.llnl.gov/asp/>

Speaker: Prof. Heino Nitsche, University of California, Berkeley/LBNL
Actinide Chemistry

Speaker: Prof. Greg Choppin, Florida State University
The Fascination of Pu Science-The Most Chemically Science Element

Speaker: Dr. Patrick Allen, Lawrence Livermore National Laboratory
Application of X-ray Absorption Spectroscopy (XAS) to Actinide Studies

Speaker: Prof. Darleane Hoffman, University of California, Berkeley/LBNL
Atom-at-a-time Nuclear Chemistry of the Transactinide Elements

Speaker: Dr. Kenton Moody, Lawrence Livermore National Laboratory
Nuclear Forensic

Speaker: Prof. Heino Nitsche, University of California, Berkeley/LBNL
Actinide Chemistry Needs for the New Millennium

Internships in Terascale Simulation Technology (ITST) Tutorial Lecture Series

URL: http://education.llnl.gov/itst/itst_schedule.html

Speaker: Alice Koniges
Parallel Computing Resources/Parallel Architecture Overview
Performance Issues, Measuring and Reporting Performance
Parallel Programming Models and Languages I
Programming Models and Languages II, Parallel I/O, Parallel file systems
Performance Optimization, Optimization Issues
Case Studies: How Much Can Performance Be Increased in a Real Application?

Speaker: Gary Kumfert
Power Presentations

Speaker: Alek Shestakov
Basic Parallelization

Speaker: Lin Yang
Parallel Applications in Physics

Speaker: Howard Scott
Mixed Models (Open MP or Pthreads with MPI)

Speaker: David Brown
PDEs in Complex Geometry

Speaker: Garry Rodrigue
Numerical Shock Simulation

Speaker: John May
Parallel I/O and Parallel Debugging

Speaker: Van Henson
A Multigrid Tutorial

Speaker: David Keyes
Parallel Solver Infrastructure

Military Academic Research Associates (MARA) Briefings

URL: http://education.llnl.gov/mara/MARA_schedule.html

Speaker: George Sakaldasis
National Security Overview

Speaker: Lt. Col LeAnn Brasure
Air Force Research Laboratory

Speaker: Fred Milanovich
Biological Weapons Overview

Tour
The National Ignition Facility

Speaker: Milt Finger
DoD Technologies

Tour and Speaker: Tom McGrann
Conflict Simulation Laboratory

Speaker: Glenn Mara
Weapons Program Overview

Tour and Speaker: Tom Ramos
CAPs

Tour and Speaker: Ron Baskett
ARAC

Summer Student Seminars/Tours/Socials

URL: <http://education-db.llnl.gov/sbb/>

- Two Brown Bag Lunches with Dr. Edward Teller
- GRE Practice Test
- ASCI Speaker/Ice Cream Social
- Tour - Exploring Environmental and Biomedical Sciences with a Powerful Analytical Technique: Accelerator Mass Spectrometry
- National Ignition Facility
- National Ignition Facility (NIF) Contamination Control
- GRE Feedback to Practice Test
- Graduate School Myths/BBQ
- How to Create Effective Poster Presentations
- Countering Biological Terrorism
- Hypervelocity Impact Studies - From the Death of the Dinosaurs to the Defeat of Iraq
- Careers with Physics: Dispelling the Myth
- Tour - An Overview of the National Atmospheric Release Advisory Center (NARAC)
- Women's Panel Discussion - Decisions for Success
- LLNL Student Poster Symposium
- Do Hamburgers Cause Cancer?
- Peregrine – Radiation Treatment for Cancer

Appendix 3

Student Presentations and Publications

Science & Technology Education Program (STEP) students were required to give an oral presentation to their technical working peers at the conclusion of their research. In lieu of a technical talk, they were also allowed the option to participate in the Lab wide student poster symposium. Feedback from the researchers on the oral and poster presentations indicated that the students gained knowledge and skills in their research area(s) which would not typically have been available at their academic level or educational institution. Management was notably impressed with how quickly the students came up to speed in support of their projects as well as how they learned new hardware and software.

Lab-wide Student Poster Symposium

URL: <http://education.llnl.gov/symposium>

The LLNL Lab-wide symposium seeks to promote undergraduate and graduate student research by providing opportunities for students to experience, firsthand, the processes of research, exploration, and discovery that characterize working with scientific and engineering teams within a national laboratory. By providing a forum to experience the art of presenting technical research, students develop an understanding of the scientific research process and expand their skills and knowledge within their academic fields of study.

Specifically, this symposium increases awareness of student research achievements, provides models of exemplary research, and facilitates student participation in the national scientific and engineering communities. The symposium creates a unique environment for celebrating and fostering appreciation of the valuable role students play in the research experience.

This year's symposium was co-hosted by LLNL and the Institutional Education Committee. Thirty students presented posters while an estimated 75 to 100 Laboratory employees and guests came to observe the event. Roger Werne, of the Nonproliferation, Arms Control and International Security Directorate, gave the opening remarks, followed by Rick Freeman, UC Davis Department of Applied Science. The keynote speaker was Dr. Noe Lozano, Associate Dean for Student Affairs, Director, Engineering Diversity Programs, Stanford University School of Engineering.

The following students participated in either the Lab-wide or the actinide student symposiums:

Posters included:

Student Name	Poster Title	Program
Brian L. Ball	Dyehuty, The Next Generation Stellar Evolution Code	ITST
Melvina Blackgoat	Establishing Component Technology Standards	ASCI Pipeline
Alda Celena Carrillo	Enhancing Denitrification in the Containerized Wetland System: Evaluation of Nitrate Removal with an External Organic Carbon Source	Summer
Robin E. Cathcart	An Assessment of Electroosmotically Aided Restoration of VOC and Tritium Contaminated Soil and Ground Water at LLNL	Summer
Jermaine L. Coburn	Genetic Algorithms	Summer
Philip M. Dudas	Software Agents for Wargaming and Simulation	ASCI Pipeline
Michael B. Flanagan	Domain Decomposition for a Periodic Layered Scattering Problem	ITST
Miguel Garcia	Novel Diode-Pumped Solid State High Average Power Laser Design	Summer
Jeffrey A. George	Analysis of Quantum Algorithms within a NMR Quantum Computer	ASCI Pipeline
Jeff R.K. Hartline	Finite Element Calculations of Positron Characteristics	Summer
Peter W. Hastings	An Investigation of Positron Annihilation Rates in Insulating Materials	Summer
Shawana Hawthorne	Neural Networks	Summer
George M. Julin	Stratigraphic Characterization of the Neroly Formation Upper Blue Sandstone Unit in the HE Process Area and B-832 Canyon, Site 300	Summer
Lekisha R. Laster	Software Change Request Tracking System (SCRTrack)	Summer
David Littau	An Evolutionary Algorithm Library for General Purpose Optimization	ITST
Ernst M. Martzen	War in Major World Religions and Ethical Systems	MARA/ROTC
Abigail E. Miller	Chemical Dip Pen Lithography	Summer
Jason V. Morgan	Re-engineering and Extending the DataFoundry Applet	ITST
John H. Niederhaus	Neutron time-of-flight detectors	MARA

Science and Technology Education Program
Appendix 3 – Student Presentations and Publications

Student Name	Poster Title	Program
Jaret H. Radford	Characterization of Velocity Profiles in Microflows	Summer
Rashad Robinson	Multilayer Synthesis by Reactive Sputtering	Summer
Kathleen M. Severyn	The Effects of Adduct Chirality on DNA Efficiency	Summer
Deirdre J. Sharkey	Effects of Fungal Growth on Long-Term Nuclear Waste Disposition	Summer
Frenae F. Smith	Liquid Scintillation Counting Optimization for Low-Level Tritium Analysis	Summer
Amanda Tran	Nondestructive Technique Survey for Assessing Integrity Of Composite Firing Vessel	GINT
Laura J. Wilcox	Analysis of Hydraulic Test Data and Development of the Conceptual Model for an Electro Osmosis Remediation Test Site	Summer
Malinda Wilson	A comparative Study of Various Sample Preparation Techniques Used for the Liquid Scintillation Analysis of Tritium in Water Samples	Summer
Mathew Zimmerman	Use of Sonic Anemometers in Tracer Transport Study	MARA/ROTC

2000 Actinide Science Summer School Poster Session

Student Name	Poster Title	Student's University
Leah Arrigo	Chemical Properties of Element 114: Group 14 Homologue Studies	Texas A&M
Kerri Blobaum	Transmission Electron Microscopy of Reactive CuOx/Al Multilayer Foils	Johns Hopkins University
Keith Gutowski	Relativistic Ab Initio Electronic Structure Determinations of Some Heavy MH and MH ₂ Species (M=Pb,Ac,No,Lr)	California Technical Institute
Ladan Hagar	Detecting Fallout Uranium Using Magnetic Sector ICP	UCSB
Olayinka Oyeyemi	Autoradiography of Soil Samples from the Nevada Test Site using Alpha and Beta Detectors	Mount Holyoke College
Jon Schwantes	Time and Temperature Studies of Pu Intrinsic Colloids	Texas A&M
Jennifer Stone	Modeling Radionuclide Migration at the NTS	UCLA
Analise Van Wyngarden	Analysis of Mixed Valency Uranium Oxides by X-ray Absorption Fine Structure (XAFS) Spectroscopy	UCB

Appendix 4 – Examples of Student Portfolios and Poster Presentations

Introduction

Besides participating in oral and poster presentations, STEP student interns are given the opportunity to have their school and research accomplishments listed on the STEP student portfolio Web site:

<http://education.llnl.gov/portfolio/>

Appendix 4 gives a few examples of the posters and respective portfolios of STEP's FY00 student interns.



Melvina Blackgoat

Northern Arizona University

Major:
Computer Science and Engineering

LLNL Program:
Center for Applied Scientific Computing

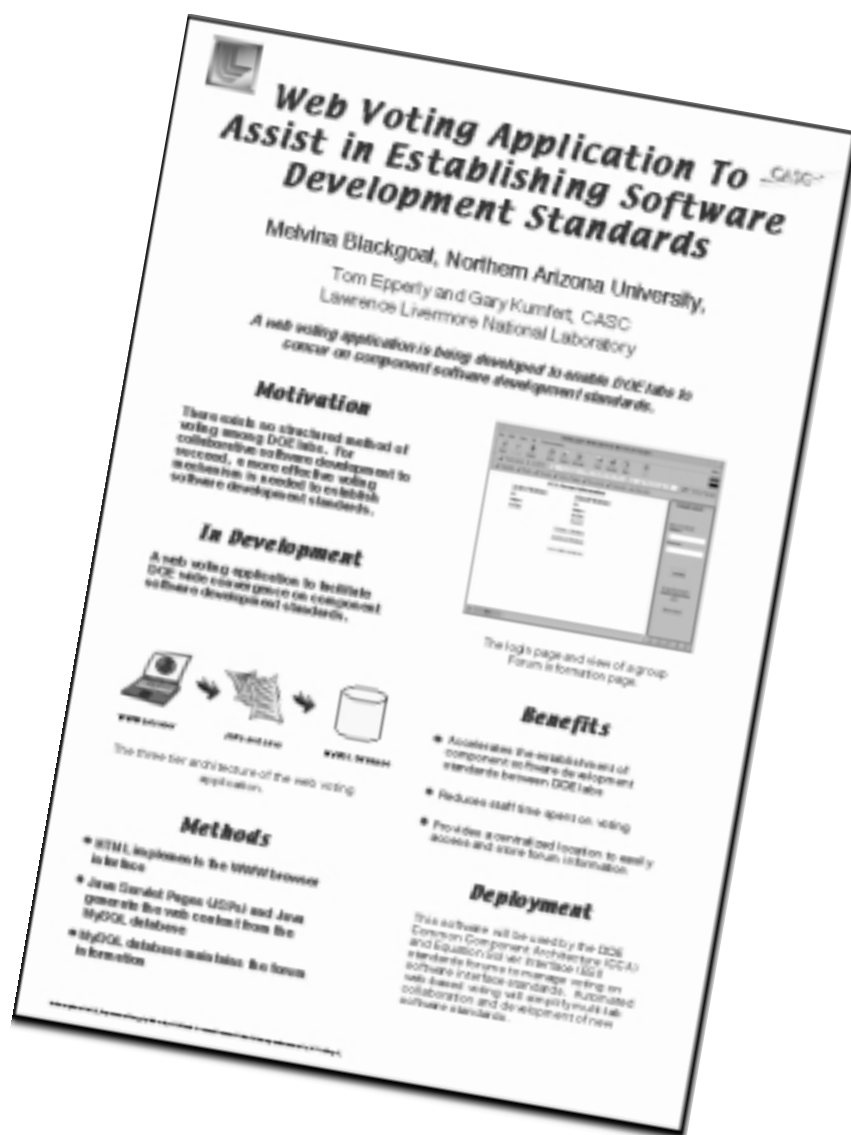
Symposium 2000 Participant

Abstract

Web Voting Application to Assist in Establishing Software Development Standards by Melvina Blackgoat Component technology is a different approach to software development. It allows software applications to be written in several different programming languages and run on several different platforms. This software development strategy builds a shared technology base that all Department of Energy laboratories can use. We are developing a distributed voting application to facilitate DOE wide convergence on component standards for scientific computing. The voting application uses a three-tiered architecture: a WWW browser interface implemented using HTML, a middle tier using Java Servlet Pages (JSPs) and additional Java, and a MySQL server as the bottom tier. We began development by creating JSPs that enter forum data into a database. JSPs are a combination of HTML content and behavior coded in Java. The Web voting application will allow users to easily access information, make comments and vote on a particular forum in a small amount of time. Currently, the voting and discussion is done during infrequent meetings or through an e-mail based voting system which requires significant amounts of staff time. When the development is completed, the Web voting application should foster component technology development between DOE labs.

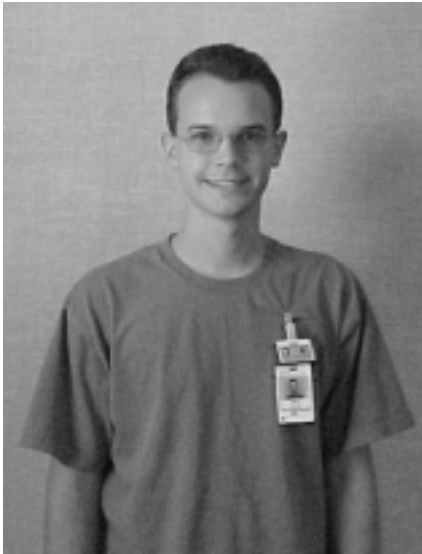
Impact on Education

Since participating in the Science and Technology Education Program, I was able to see first hand what researchers in my field of study are doing. I was able to work on a project that combined what I have learned at school into a real working software application that the lab will use. My experience has also motivated me to do better academically and to widen my perspective to new subject areas.



Poster Abstract

Component technology is a different approach to software development. It allows software applications to be written in several different programming languages and run on several different platforms. This software development strategy builds a shared technology base that all Department of Energy laboratories can use. We are developing a distributed voting application to facilitate DOE-wide convergence on component standards for scientific computing. The voting application uses a three-tiered architecture: a WWW browser interface implemented using HTML, a middle tier using Java Servlet Pages (JSPs) and additional Java, and a MySQL server as the bottom tier. We began development by creating JSPs that enter forum data into a database. JSPs are a combination of HTML content and behavior coded in Java. The Web voting application will allow users to easily access information, make comments and vote on a particular forum in a small amount of time. Currently, the voting and discussion is done during infrequent meetings or through an e-mail based voting system which requires significant amounts of staff time. When the development is completed, the Web voting application should foster component technology development between DOE labs.



Matthew Davis

University of the Pacific

Major: Computer Engineering
and Engineering Management

LLNL Program:
Networks and Advanced Communication

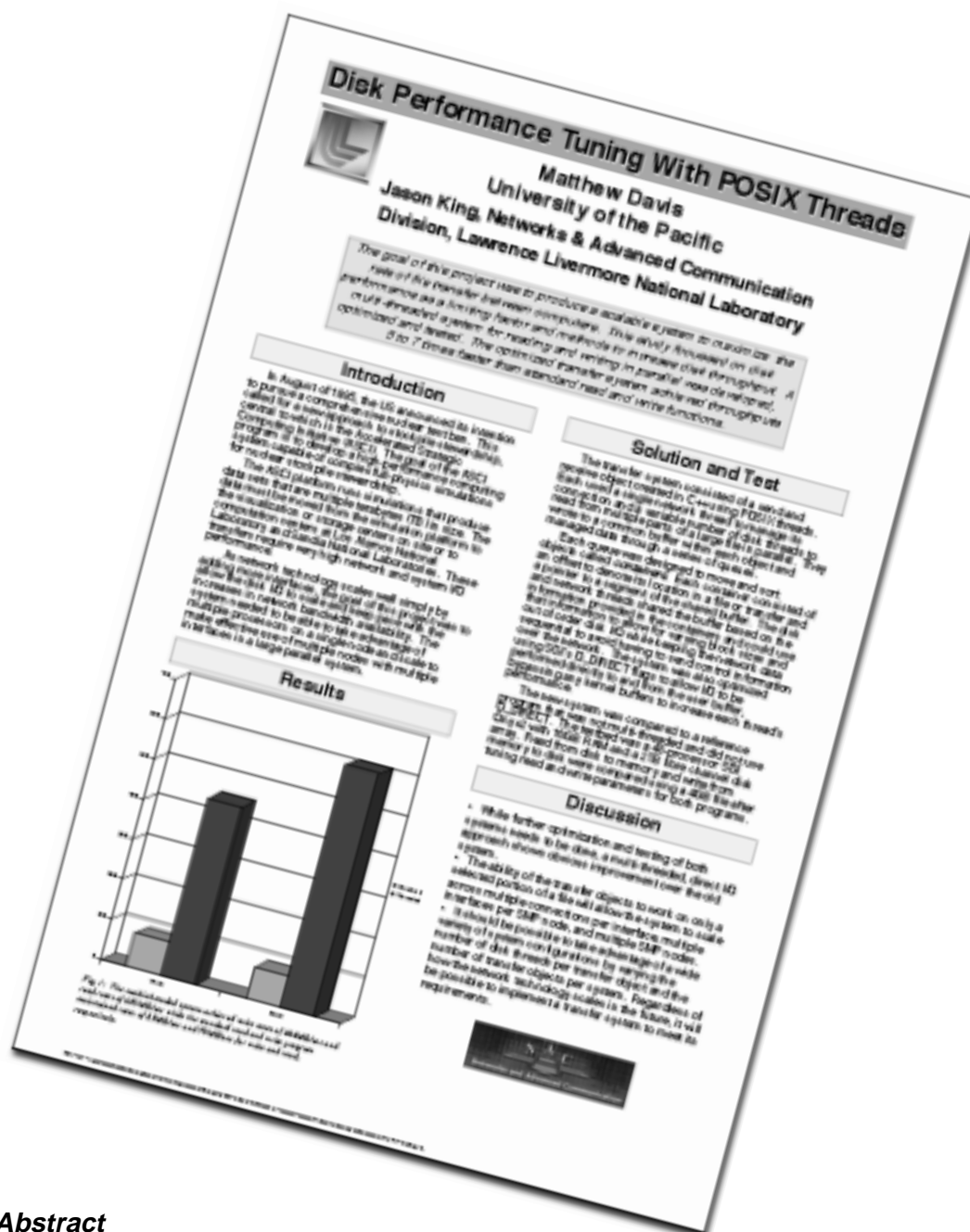
Symposium 2000 Participant

Abstract

The goal of this project was to produce a scalable system to maximize the rate of file transfer between computers. This study focussed on disk performance as a limiting factor and methods to increase disk throughput. A multi-threaded system for reading and writing in parallel was developed, optimized and tested. The optimized transfer system achieved throughput five to seven times faster than standard read and write calls on a multiple disk system.

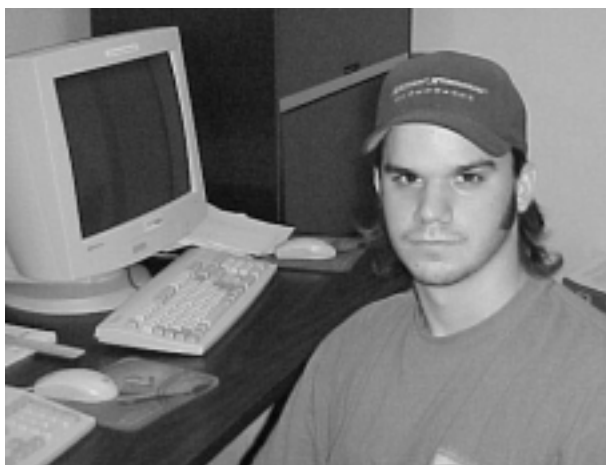
Impact on Education

This summer's experience gave me the opportunity to work on systems that are unavailable to me at school and produce a truly useful piece of software for the first time. I learned how to use POSIX threads, tricks to optimize disk I/O, and improved my skills at designing efficient data structures. I will take several useful skills and some good experience back to my classes this fall, and as an entering sophomore, I have a better idea of what I would like my technical focus to be.



Poster Abstract

No abstract was provided.



Phil Dudas

Northern Arizona University

Major:
Computer Science and Engineering

LLNL Program:
Dept. of Applied Science/Computations

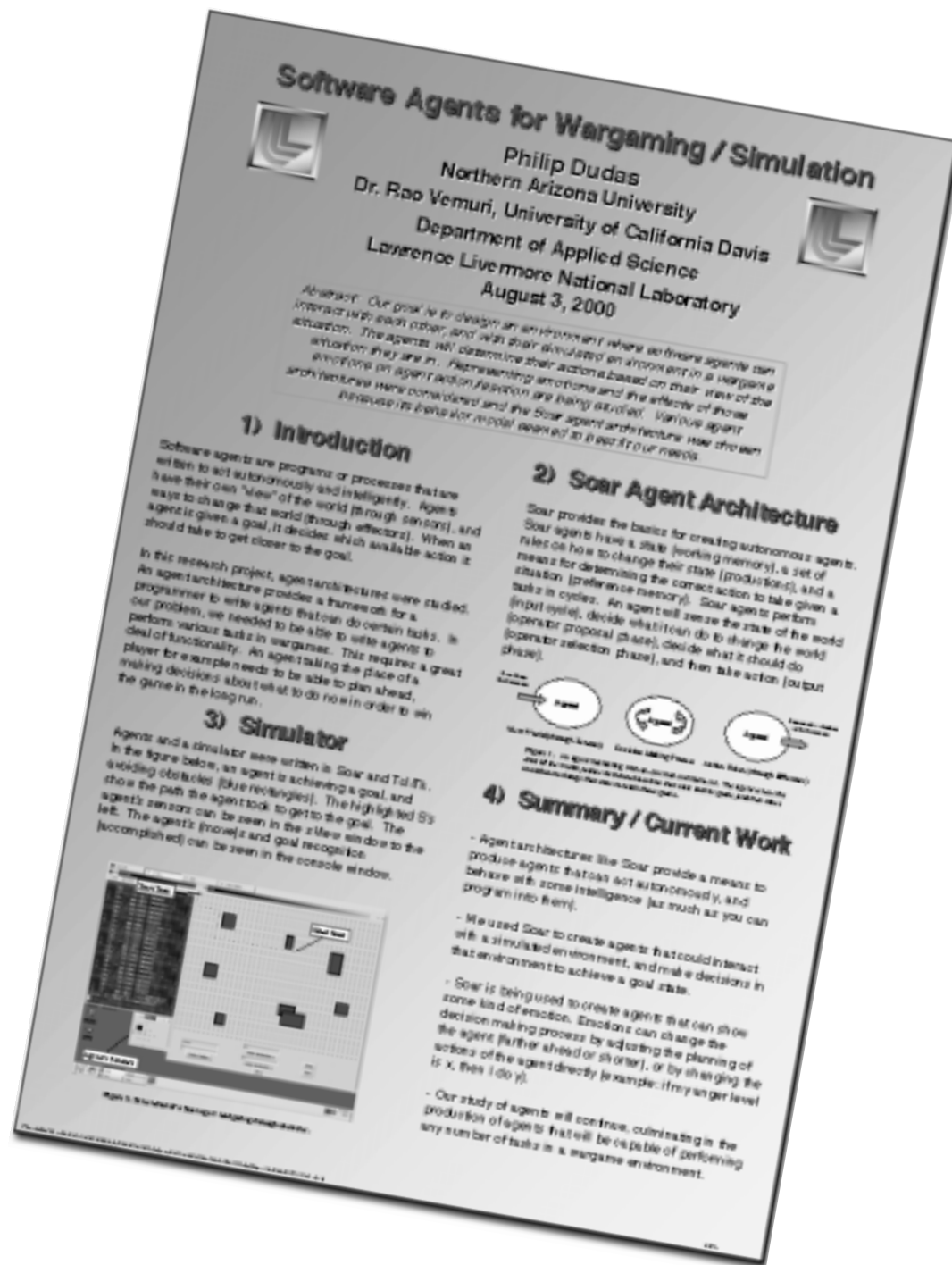
Symposium 2000 Participant

Abstract

Our goal is to design an environment where software agents can interact with each other, and with their simulated environment in a wargame situation. The agents will determine their actions based on their view of the situation they are in. Representing emotions and the effects of those emotions on agent action/reaction are being studied. Various agent architectures were considered and the Soar agent architecture was chosen because its behavior model seemed to best fit our needs.

Impact on Education

This project has had a significant impact on my education. I have been interested in artificial intelligence for some time, but now I actually have gotten my hands dirty using it. I am going to continue on this project, and will be working on another project involving artificial life. I plan to learn more about artificial intelligence, and am thinking about going to graduate school for Computer Science, basing my study around artificial intelligence.



Poster Abstract

Our goal is to design an environment where software agents can interact with each other, and with their simulated environment in a wargame situation. The agents will determine the actions they should take based on their view of the situation they are in. Representing emotions and the effects of those emotions on agent action/reaction are being studied. Various agent architectures were considered and the Soar agent architecture was chosen because its behavior model seemed to best fit our needs.



Mitch Martzen

Baylor University

Major: Political Science/
Environmental Studies

LLNL Program:
Science and Technology
Education Program

Symposium 2000 Participant

Abstract

The purpose of my project was to research the world's concepts of "Just War," specifically taking into consideration the major religions and ethical traditions whose philosophies might have an effect on world politics and the prevention of war in today's global environment. The traditions that I researched during the course of my project included Chinese Communism, Buddhism, Hinduism, Islam, and Christianity.

Impact on Education

This project helped me realize the interdisciplinary nature of our nation's defense needs.

Further Information

Our nation's intelligence and readiness extends to cultural understanding. This understanding leads to better international relations so that we may better interact with other nations and pursue peace with them in a more efficient manner. A major component of understanding a culture is understanding their religion. Religions often have specific teachings and applications regarding warfare which can be invaluable to understanding a nation's reaction in a potentially hostile situation.



Poster Abstract

The purpose of this project is to research the world's concepts of "Just War," specifically taking into consideration the major religions and ethical traditions whose philosophies might have an effect on world politics and the prevention of war in today's global environment.



Jason Morgan

University of Utah

Major: Computer Science

LLNL Program: CASC / DataFoundry

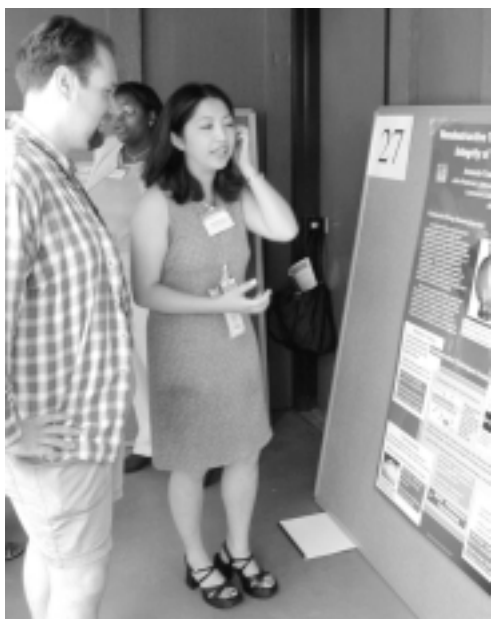
Symposium 2000 Participant

Abstract

Future software maintenance costs can be reduced by reengineering existing source code to reflect good software engineering techniques. The DataFoundry applet, a Java front end for genetic research prototype software, was targeted for reengineering to ease the implementation of new features. Modifying a large section of code that handled most of the user interface and data manipulation features by converting it into several smaller sections of code to handle the user interface and individual features separately was the biggest change made to the architecture. The new architecture is now easier to work with and helped further the applet's development. One major new feature being introduced allows scientists to analyze multiple genetic sequences at once. This will save research time and increase productivity.

Impact on Education

The experience I obtained by working on the DataFoundry applet this summer will help me when managing the class software projects. It also has helped me to see what coursework is most valuable to a career in computer science. Another impact this summer may have made on my education is its impact on how I view graduate school. I am much more inclined to consider graduate school after having worked out here than I was before this summer.



Amanda Tran

University of the Pacific

Major: Electrical Engineering

LLNL Program: DSED/DTED

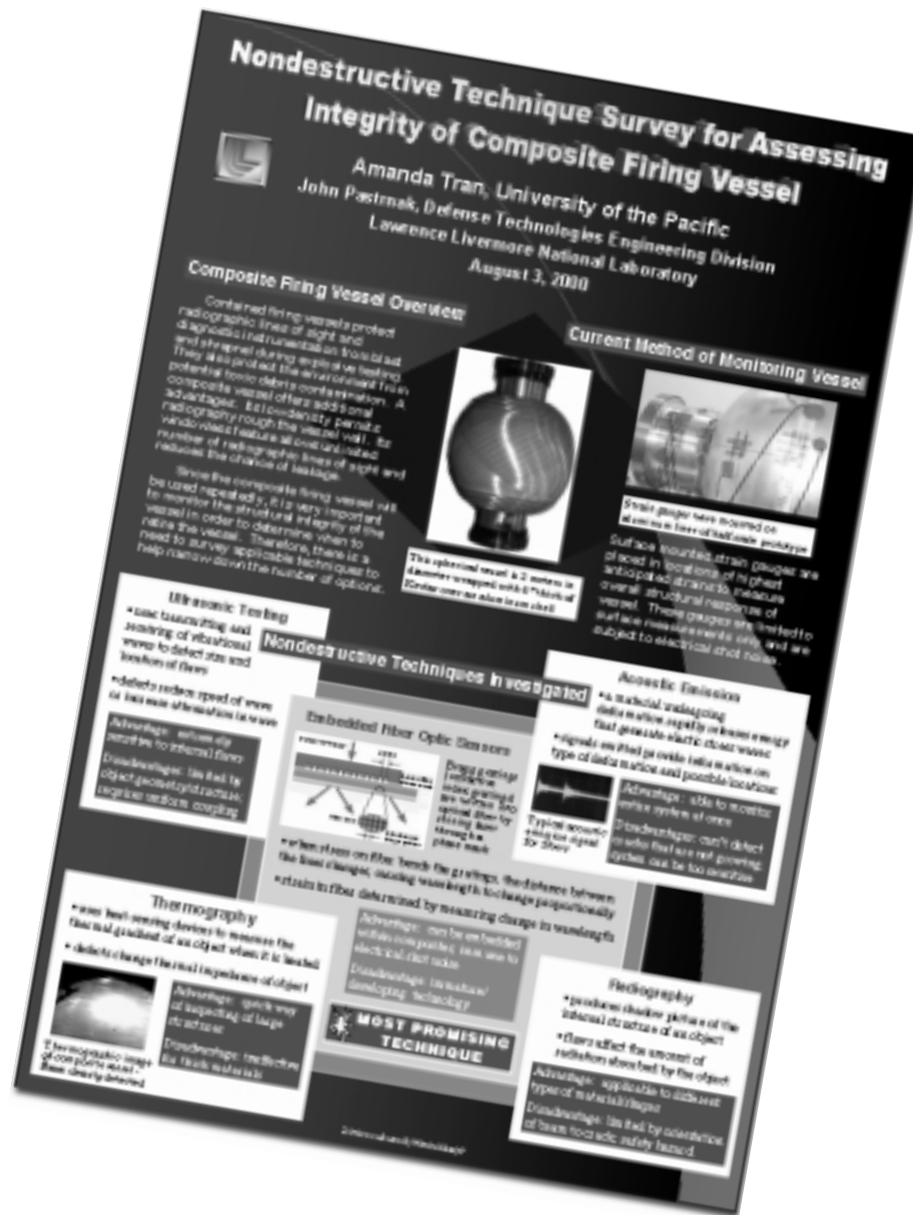
Symposium 2000 Participant

Abstract

The repeated use and limited lifetime of a composite firing vessel compel a need to survey techniques for monitoring the structural integrity of the vessel in order to determine when it should be retired. Various nondestructive techniques were researched and evaluated based on their applicability to the vessel. The methods were visual inspection, liquid penetrant testing, magnetic particle testing, surface mounted strain gauges, thermal inspection, acoustic emission, ultrasonic testing, radiography, eddy current testing, and embedded fiber optic sensors. It was determined that embedded fiber optic sensor is the most promising technique due to their ability to be embedded within layers of composites and their immunity to electromagnetic interference.

Impact on Education

This experience has enabled me to explore various areas in engineering, such as computer programming, data analysis, nondestructive technique research, and sensor application. I also had the opportunity to learn how to design posters, give a technical presentation, and write a formal report. However, I believe that the most valuable aspect of my internship was being mentored by engineers and technicians from different fields and background. Through this experience, I was able to gain a better understanding of what I would like to pursue in my career.



Poster Abstract

The repeated use and limited lifetime of a composite firing vessel compel a need to survey techniques for monitoring the structural integrity of the vessel in order to determine when it should be retired. Various nondestructive techniques were researched and evaluated based on their applicability to the vessel. Methods included thermography, acoustic emission, ultrasonic testing, radiography, and embedded fiber optic sensors. It was determined that embedded fiber optic sensor is the most promising method due to their ability to be embedded within layers of composites and their immunity to electromagnetic interference.



Matthew Zimmerman

Cornell University

Major: Environmental Engineering

LLNL Program:
Health and Ecological Assessment Division

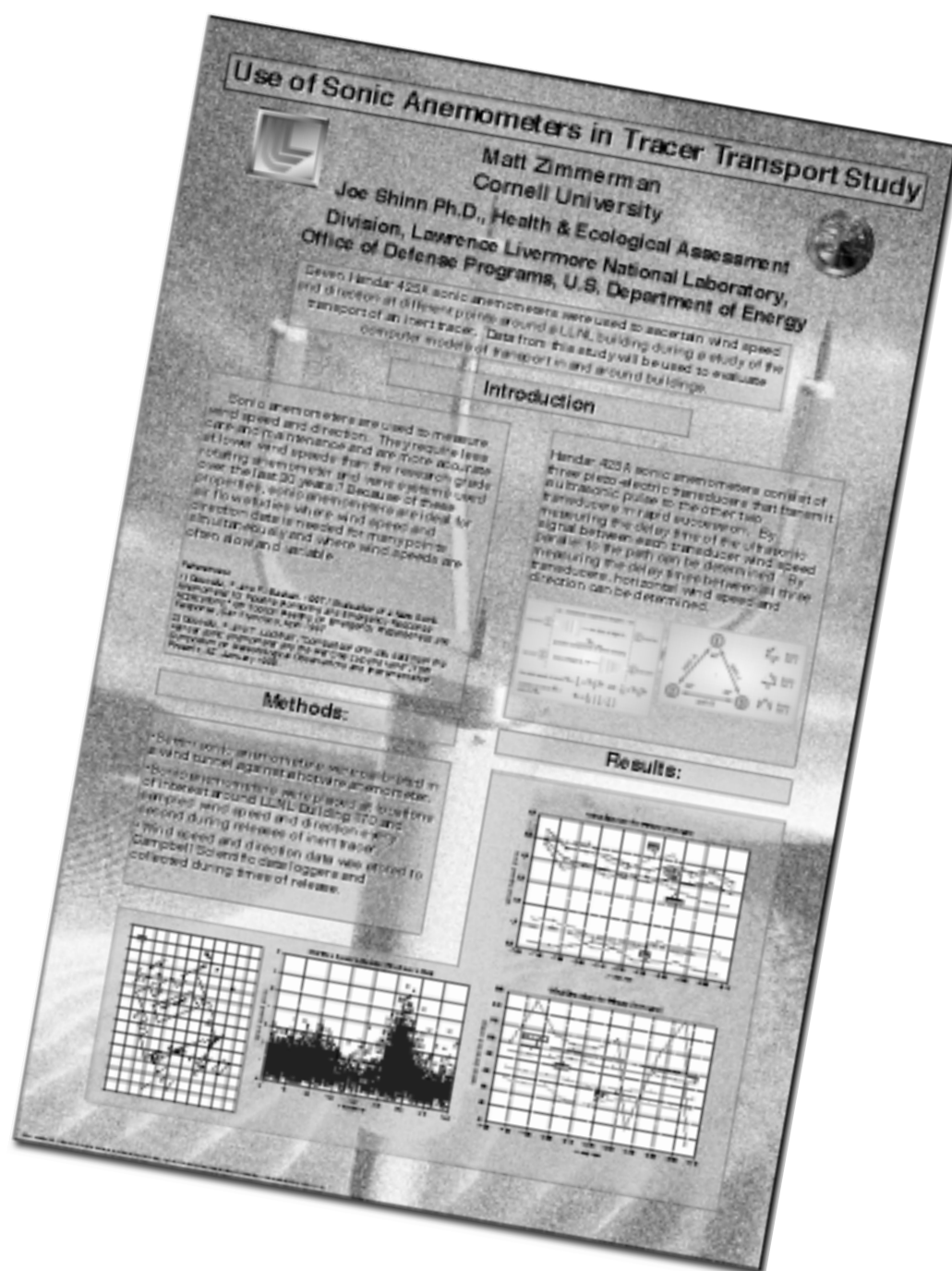
Symposium 2000 Participant

Abstract

This summer I participated on a program to measure the dispersion of particles in and around buildings which has applications in chemical and biological non-proliferation. I helped calibrate, set-up, and program an energy budget station that included a cup-and-vane anemometer, four thermistors, three ground flux plates, a net radiometer, and a data logger. I also calibrated several sonic anemometers against a hot-wire anemometer in a wind tunnel and helped set them up around a building on the Lab's grounds. My primary responsibility became to collect the data from these sonic anemometers during releases of an inert tracer gas upwind of the building and later analysis the data using a spreadsheet. I have also worked with a portable infrared ambient air analyzer and atmospheric pressure sensors.

Impact on Education

I have learned a lot about environmental transport and how measurements are taken in the field. I have also learned about computer modeling in relation to empirical data and calibrate, set-up, and use various instruments used in transport studies.



Poster Abstract

Seven Handar 425A sonic anemometers were used to ascertain wind speed and direction at different points around a LLNL building during a study of the transport of an inert tracer. Data from this study will be used to evaluate computer models of transport in and around buildings.

Appendix 5 – Other LLNL Education Programs

By making LLNL research facilities and staff accessible to the academic and industrial communities, we can provide valuable opportunities to visiting researchers. We are home to several University of California scientific research institutes and other centers that support hundreds of ongoing projects with faculty, post-doctoral fellows, and graduate students.

We also help train the nation's next generation of scientists and engineers through our science and technology outreach programs that span every educational level.

Affirmative Action and Diversity Outreach Programs

URL: <http://www.llnl.gov/aadp/zoutrea.html>

Represents the Laboratory to diverse communities as a resource for employment, education, and commercial ventures. For example, the American Indian Program independently reviews and prioritizes action items relating to American Indian issues for the Laboratory and Department of Energy.

Department of Applied Science

URL: <http://das.ucdavis.edu>

The Department of Applied Science is a part of the College of Engineering at the University of California, Davis. With facilities at both Davis and Livermore, the department provides graduate training in physics, chemistry, and engineering to help future scientists and engineers assume productive roles in applied research.

Postdoctoral Program

URL: <http://www.llnl.gov/urp/PostDoc/PostDocInfo.html>

Broadens scientific research experience for individuals who have received a Ph.D. degree within the last five years. Postdoctoral appointments are awarded for up to three years to exceptional candidates with potential for significant achievements. Also available is the prestigious Lawrence Livermore Postdoctoral Fellowships, where candidates show definite promise of becoming outstanding leaders in their research field.

Student and Faculty Opportunities

URL: <http://education.llnl.gov/student/index3.html>

A variety of research participation programs, fellowships, collaborative projects, and special programs are available for high school and university students. There are also numerous additional opportunities and educator resources and education outreach programs available through Lawrence Livermore National Laboratory.

Summer Employment Program

URL: <http://www.llnl.gov/llnl/02summer/SEP.html>

Offers full-time science and technology summer research appointments, for up to 12 weeks, to undergraduate and graduate students, university faculty, high school and secondary teachers and, occasionally, high school students.

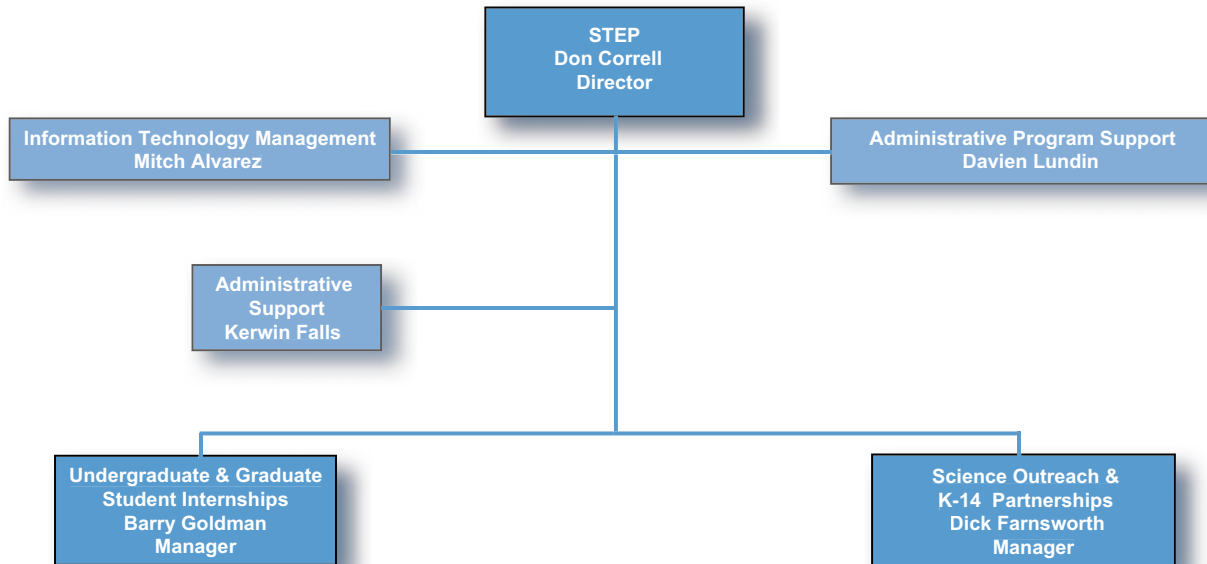
University Relations Program

URL: <http://www.llnl.gov/urp/>

The University Relations Program encourages and expands research collaborations between Lawrence Livermore National Laboratory and universities, other research organizations, and industries. The program contributes to the intellectual vitality of all the partners through basic and applied research collaborations, which address complex problems of importance to the nation.

Appendix 6

STEP Contact Information



Name	Phone Number	Fax Number	E-mail Address
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Livermore, CA 94550

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E-mail: education@llnl.gov

Web site: <http://education.llnl.gov/>



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